November 1954

MECHANICAL ENGINEERING

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ASME Annual Meeting, New York, N. Y.
Nov. 28–Dec. 3, 1954

All it takes are heat, water, and a pot. It's as simple as that, at least for tea, vegetables, and soft-boiled eggs.

But take this same principle with the same elements and apply it to the insatiable appetite of American industry for power. How big do the "pot" and "stove" have to be to boil 200,000 gallons of water in an hour, at thousands of pounds pressure, with temperatures over 1000 F, using any fuel from lignite to natural gas?

The answer is plenty big – often bigger than a 15-story building. And, along with that, the little lady in the apron becomes a corps of power engineers whose task it is to design, build, and operate these fantastically efficient boilers for the conversion of heat into usable power.

The light, heat and power needs of America are great and ever-growing – a growth that, at B&W, is being fed by *engineering*. Higher pressures, increased temperatures, the winning battle for more heat from less fuel – are the problems that must be solved and *are* being solved.

B&W developments like Cyclone Steam Separators, coal pulverizers, advances in oil and gas firing, Cyclone Furnaces, pressure firing, high-temperature alloy steels, shop-assembled steam generators, and waste heat boilers and similar heat recovery equipment are advances in the generation of power that cut bigger jobs down to size.

So today, as yesterday, B&W engineers turn their talents to finding better ways to "boil water" – to fill tomorrow's greater power needs for all America.

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BOILER DIVISION

N-186

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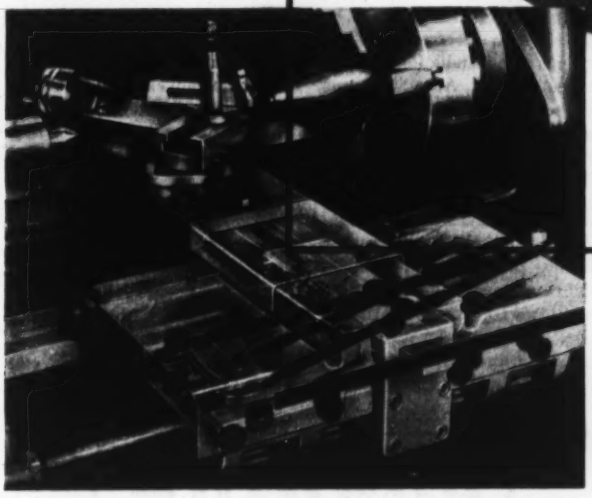
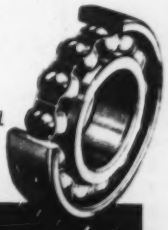


Twenty New Departure ball bearings are used in the Monarch Machine Tool Company's antifriction bearing taper attachment. There are 12 single-row bearings, 8 double-row bearings. All are permanently lubricated.

Many advantages of the Monarch lathe taper attachment are—according to its maker—the result of New Departure **ball** bearings. For by their use, backlash, friction and lost motion are almost entirely eliminated . . . smoother, more accurate tapers are possible. And Monarch's taper attachment takes heavy cuts even when boring or turning acute angles, for **ball** bearings give rigid support under both radial and thrust loads.

Call your New Departure sales engineer. Have him show you how New Departure ball bearings make a good product *even better!*

NOTHING ROLLS LIKE A BALL



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Let your Bruning Man show you how the unique design of Hamilton Auto-Shift Tables not only can help you solve present problems but also allow for orderly, integrated expansion.

How Auto-Shift increases space and operating efficiency

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Auto-Shift provides convenient foot and hand releases for instant, effortless one-man adjustment of height and slope. Counterbalanced top allows finger-tip control of slope. Draftsman can change position often and yet reach any part of the board without strain whether seated or standing. He works faster and easier; production rate goes up!

See for yourself how the advantages of Auto-Shift can increase space and operating efficiency in your drafting room. Mail the coupon below for detailed information.

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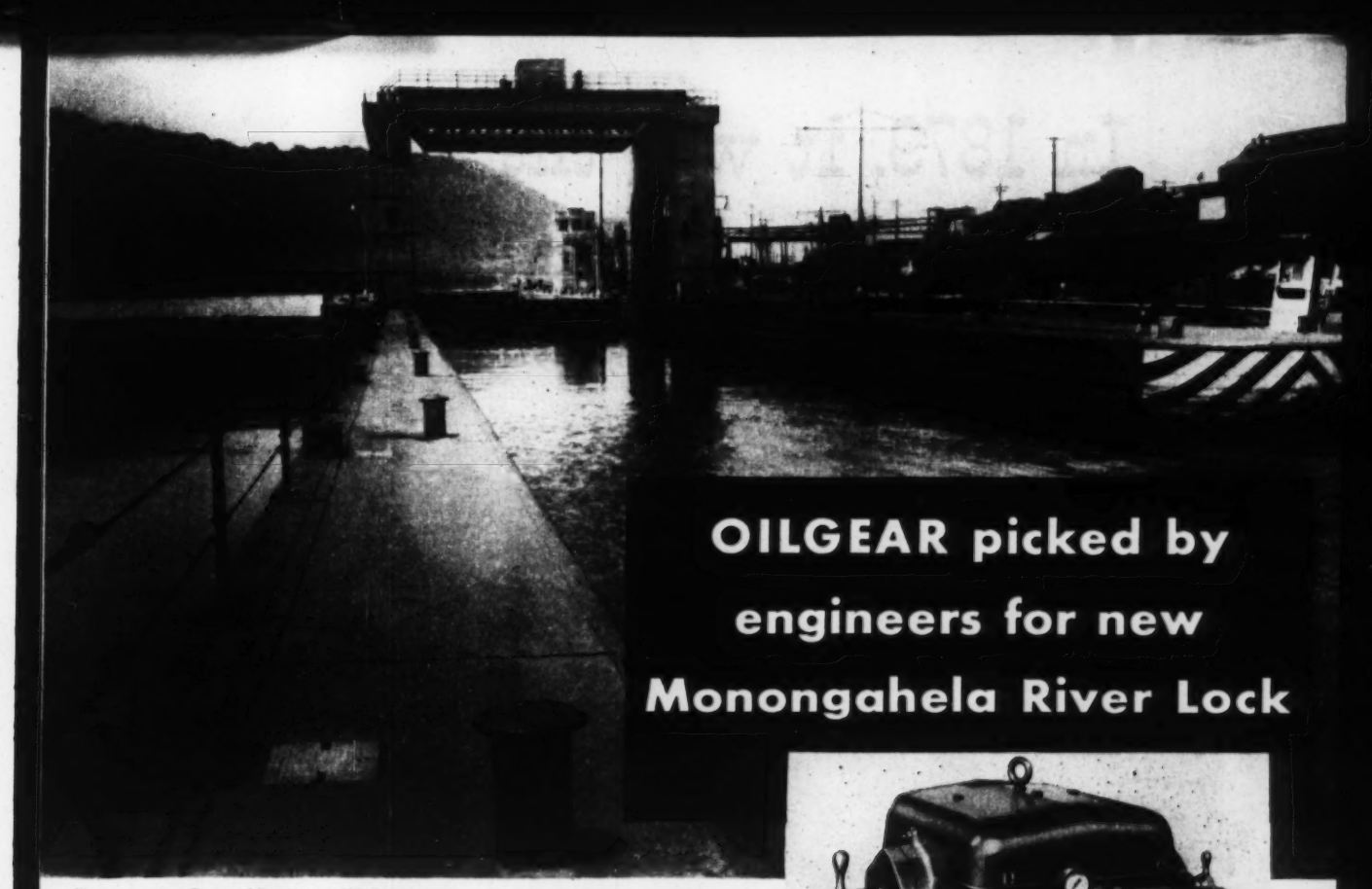
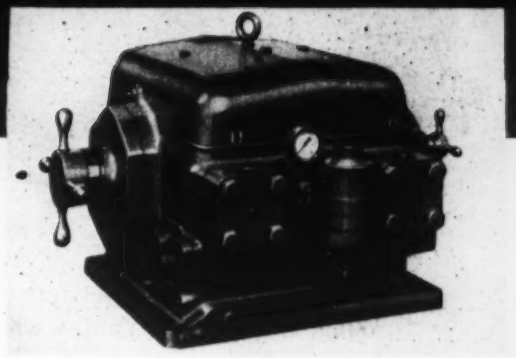


OILGEAR picked by engineers for new Monongahela River Lock

Photo courtesy Corps of Engineers, US Army



Oilgear Two-way Variable Delivery Pump with Electro-hydraulic Three-position Remote Control.

This versatile fluid power also used in McNary Dam and Bayou Boeuf Locks

The problem of selecting the power to operate the lock gates, butterfly valves and capstans in the new Monongahela River Lock was to provide the speed of operation, the capacity and the dependability that would keep the rapidly growing volume of shipping on the move. The river at this point now handles millions of tons more annually than Panama.

Certainly, in the fact that Oilgear Fluid Power equipment was selected for this lock, as well as for those at McNary Dam in Oregon, and at Bayou Boeuf in Louisiana, is evidence of the repute in which Oilgear is held.

But we are inclined to stress the *versatility* of Oilgear Fluid Power . . . its applicability to a wide range of needs ranging from the impressive capacity required for lock operation . . . to the delicate and assured precision, controllability and accuracy required in printing on flimsy cellophane . . . and to the middle ground of industry where production must always be increased and always kept on the move.

Fundamentally there is no difference. There must be power, *ample* power, susceptible of control some times rushing and gigantic, some times a mere whisper of power whittled down to a point, as it were.

With Oilgear Fluid Power available in pump and cylinder for straight line motion, or in pump and motor or integrated transmission for rotary motion or reduction of ratio, you have a power source and method applicable to any need. In addition, you gain ability to vary speed or power steplessly in an extremely broad ratio. You can have power that does not move but simply holds a member under constant pressure. You can have speed that clings closely to the changing viscosity of a beaten mass... or power that forms giant airplane fuselages and wings.

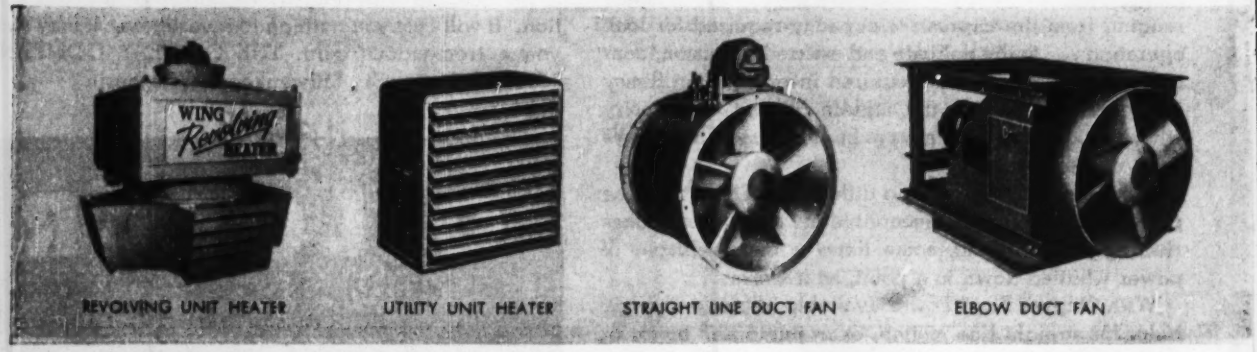
Whatever your problem, it deserves the opportunity to be matched with Oilgear versatility for a better solution. It will cost you nothing to investigate. It may show you a tremendous gain. THE OILGEAR COMPANY, 1570 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR

In 1879, it was the new "Wing's Disc Fan"

It was 75 years ago that L. J. Wing, an ingenious Yankee who had come to New York with some ideas about mechanical devices, formed the company which later became the L. J. Wing Mfg. Co., for the purpose of manufacturing and selling "Wing's Disc Fan" which, according to his catalog, would "move more air than any other Fan made for heating, ventilation, drying, etc., as competitive trials have shown". Today, Wing products for ventilation, heating and combustion are known for their efficiency and dependability in all parts of the world. The company Mr. Wing founded has kept his ideals of originality and excellence constantly before them.



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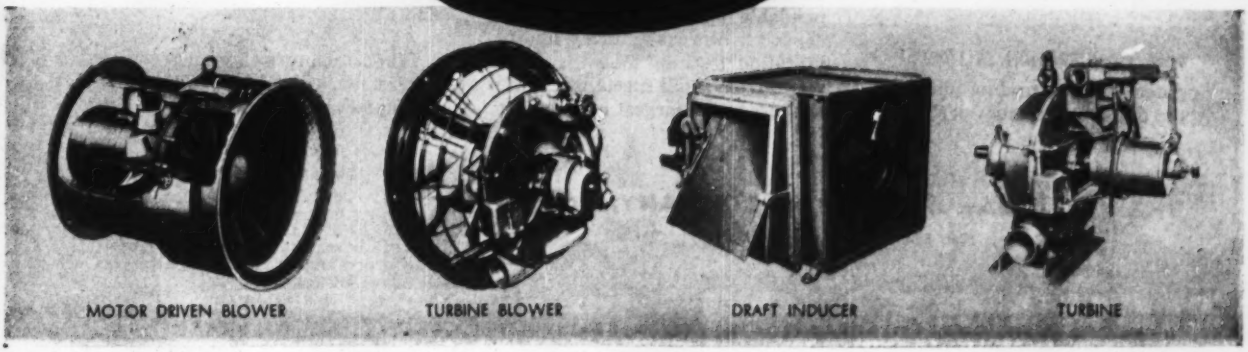
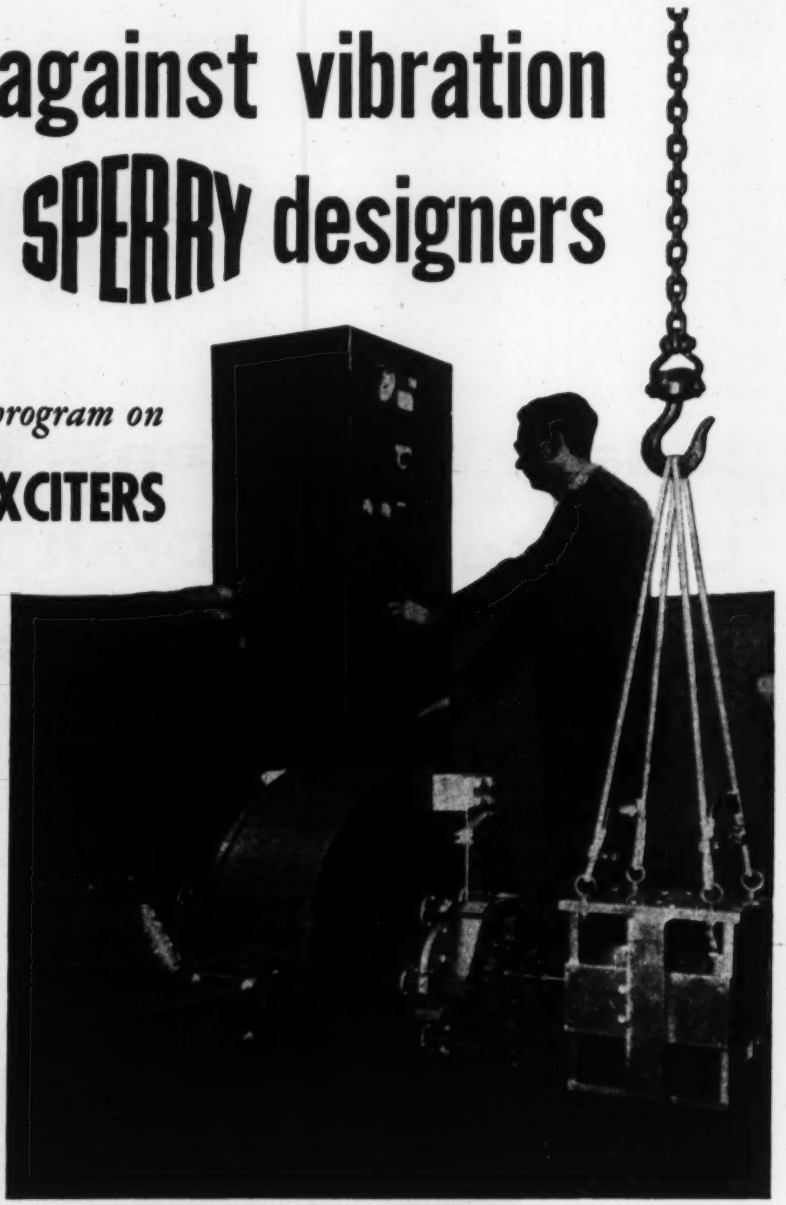


Durability against vibration assured by SPERRY designers

. . . with a shake-testing program on

MB VIBRATION EXCITERS



In a Vibration Test Section of Sperry Gyroscope Company, an MB Vibration Exciter Model C-5 is being used to fulfill requirements of MIL-E-5272 and other specification tests.

COMPANIES quick to take advantage of newest techniques for development and testing are generally also those known for outstanding products. Such a concern is the Sperry Gyroscope Company. It maintains well-equipped vibration testing laboratories where searching tests are performed on all designs subjected to vibration in service. Vibration is ruled out as a trouble-maker in vital products and components.

VIBRATION TESTING SPEEDS DATA

With vibration now recognized as an archenemy of product life and performance, it pays to learn early in the game whether corrections in design are needed. MB Shakers can help *you* to do just that. In a few short hours, the equipment can reproduce the ravages of *years* of vibratory service conditions. Within minutes, it can show you visually the vibratory response of a product to a whole range of frequencies.

The result: *savings in engineering time and work, and a better product.*

WHY MB VIBRATION EXCITERS?

Engineered by vibration specialists to deliver maximum performance, MB Shakers can be counted on for pure table motion and dependable operation to full rated capacity. Moreover, MB's line of vibration testing "tools" is complete—from small specialized-duty shakers to the largest in existence today; also automatic cycling systems, vibration pickups, meters and other accessories.

Like so many well known companies, why not make MB *your* headquarters on vibration?

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BULLETIN TELLS MORE
Contains specifications, operating information and helpful hints on usages of the complete line of MB Exciters. Write for Bulletin 1-VE-4.

HEADQUARTERS FOR PRODUCTS TO *ISOLATE* VIBRATION...TO *EXCITE* IT...TO *MEASURE* IT

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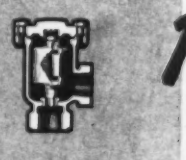
Which type of steam trap is best for your need?

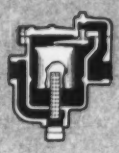


1 Sarco Balanced Pressure Thermostatic

Greatest capacity per dollar cost. Large air venting capacity. Same head and seat, 0-300 psi. Freeze-proof. Cat. 250-A

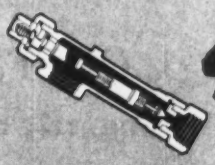
2 Sarco Float-Thermostatic

Discharges condensate continuously at steam temperature and without shock. Responds immediately to varying loads and pressures. Cat. 450-A



3 Sarco Camlift Bucket

New, powerful Camlift valve mechanism permits greater discharge with no increase in size of trap body. Cat. 360-A



4 Sarco Liquid Expansion

Adjustable to discharge condensate below 212°F. Freeze-proof. Not affected by water-hammer or pressure pulsations. Cat. 260-A

5 Sarco Thermodynamic

Valve head, a solid stn. st. disc, is only moving part. Same head and seat to 600 psi. Not affected by superheat, water-hammer, corrosive condensate. Cat. 255-A

With these 5 different types to offer, Sarco can give you impartial advice

Any type of steam trap will do "some kind" of a steam trapping job for you.

But there's a world of difference in trapping efficiency when exactly the *right* type of trap is used for a given application.

That's because both trapping conditions and the characteristics of different types of traps vary widely. There simply isn't any *one* type of trap that will do an efficient job under *all* circumstances. But there is always a particular type of trap best suited for each *specific* set of conditions.

That is why Sarco makes all 5 basically *different* types of traps. In a nutshell, it's to assure you of best trapping results at all times, regardless of requirements.

And don't overlook the very important fact that *only* Sarco makes all these 5 types — not merely variations of one type. Therefore, Sarco can give you absolutely impartial trapping recommendations, backed by 43 years of field experience. Call your local Sarco representative or write:

SARCO COMPANY, INC., Empire State Building, New York, N. Y. Represented in Principal Cities.

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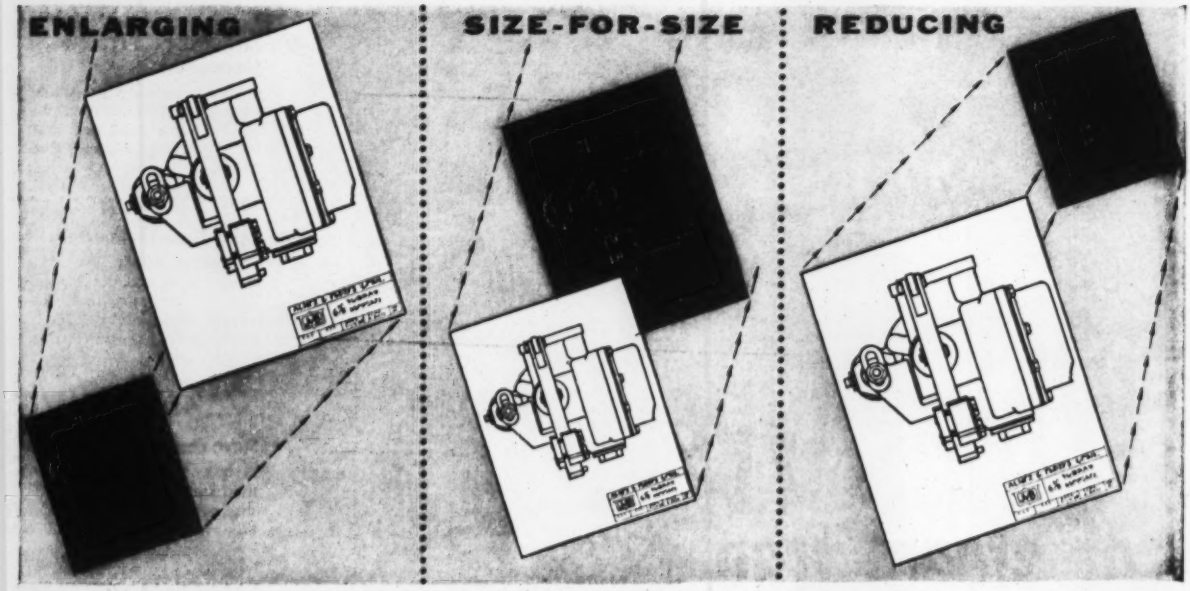
ONLY SARCO makes all 5 types of traps

—not merely variations of one type!

SARCO SAVES STEAM



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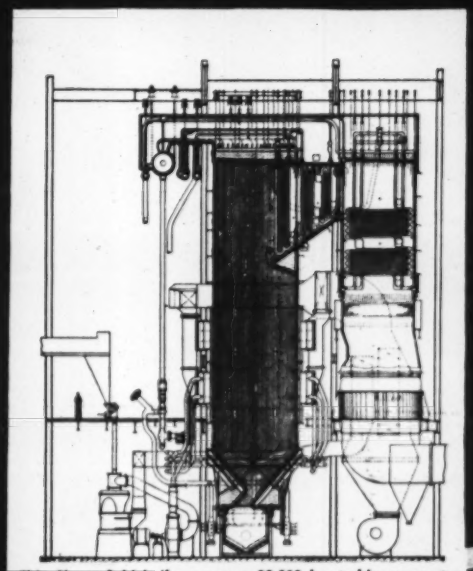
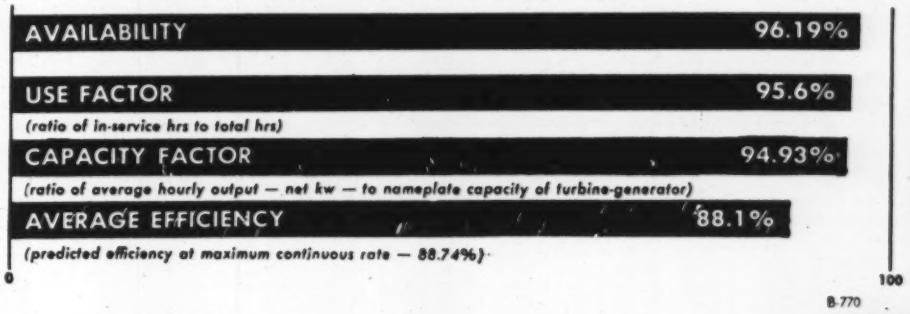


This Chesterfield boiler serves a 90,000 kw turbine-generator operating at a throttle pressure of 1450 psi with a primary steam temperature of 1000 F, reheated to 1000 F.

CONTROLLED CIRCULATION at CHESTERFIELD . . .

Performance Record

Since mid-1950, utility companies have ordered 43 C-E Controlled Circulation Boilers to serve an aggregate turbine capacity of 6,375,000 kw. Twelve of these boilers have been placed in service, the first of which went on the line on December 1, 1952, at the Chesterfield Power Station of the Virginia Electric & Power Company. Operating records of this boiler for the twelve-month period ending December 31, 1953 show the following principal results:



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. . . in large power plant

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You'll get the benefit of modern shop facilities for hot and cold bending, welding and fabricating all types of piping. A metallurgical research laboratory which assures you of the latest developments in high pressure, high temperature piping. The most modern testing equipment to assure the soundness and strength of the piping.

Plus a complete service force with modern machinery for field work and erection . . . and the necessary manpower to handle jobs of any size.

What service do you require?

We will, for instance, (1) engineer, fabricate, and erect your job . . . or (2) simply fabricate and erect . . . or (3) fabricate only.

Our engineers will quote from your drawings . . . or, when desired, make a field study of your piping requirements before quoting.

Just let us know what service you want . . . and we'll provide it.

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Power Piping and Sprinkler Division
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Complete prefabricated power piping systems for all pressures and temperatures . . . plus complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators

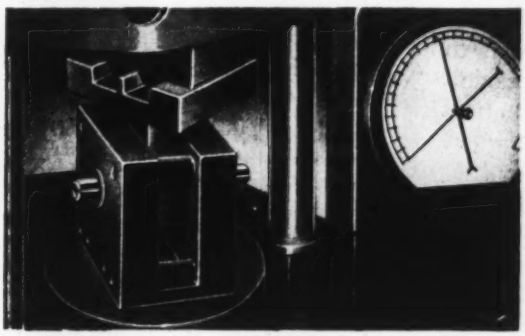
Normal leverage puts the load on the pins at these points. Pins must have a high resistance to shearing – and every pin must stand up to plenty of abuse. Many manufacturers' tests have proved Rollpin's uniformly high shear strength.

consistent strength... as important in the pin as in the socket

The Moore Drop Forging Company, who manufactures the famous Craftsman wrenches for Sears Roebuck and Co., used stainless steel rivets to fasten the universal joint on their Flex sockets. Thorough testing, under all possible load conditions and drive angles, convinced them that Rollpin was stronger than the stainless steel rivet previously used. This led to a redesign of the joint with Rollpins replacing the rivets. Also, the spring tension inherent in the Rollpin locking principle was used to provide the "drag" that holds the socket head in angular position. The result . . . an improved product at lower cost.

Dependability like this is based on the rigid ESNA® quality controls that insure consistent strength and mean reliable performance by every Rollpin.

Moore Drop Forging Company was able to save assembly time, too. Rollpin is simply driven into holes drilled to normal production tolerances. It compresses as driven, locking itself in place by exerting pressure on the hole walls. In this case, the extra operation of spinning on a rivet head was eliminated.



We urge you to test spring pins before you buy – for uniformity of diameter and length, hardness, insertion and removal forces, and recovery of diameter, as well as shear strength.

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Please send me the following free fastening information:

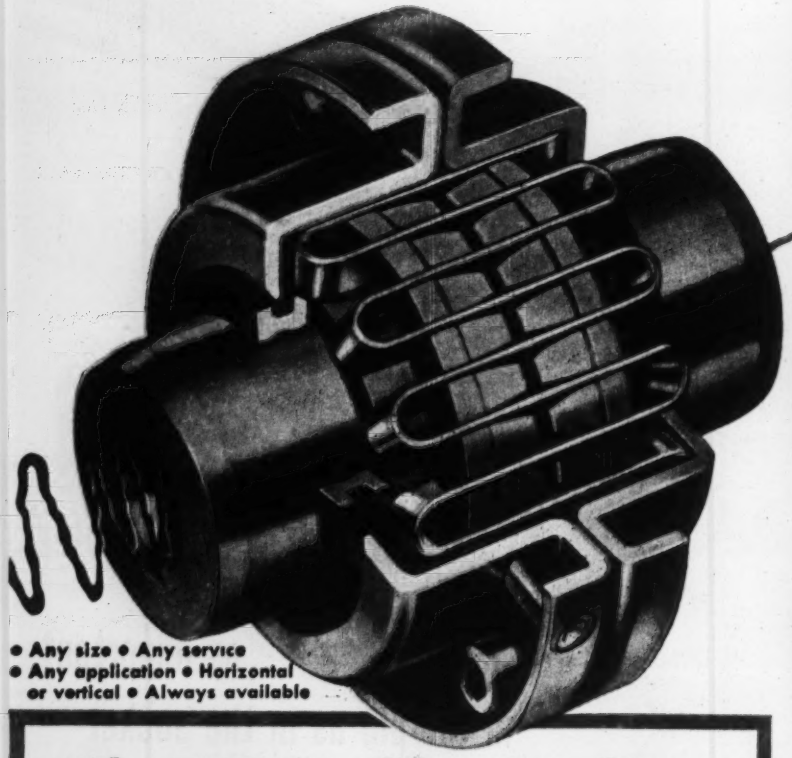
☐ Rollpin samples
☐ Rollpin bulletin
☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

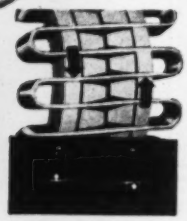
City _____ Zone _____ State _____



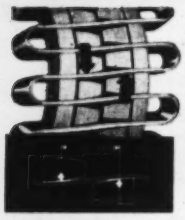
• Any size • Any service
• Any application • Horizontal or vertical • Always available

Exclusive FALK Steelflex grid-groove design smothers shock and vibration.

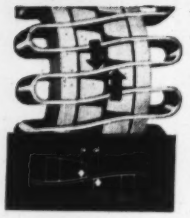
The damaging effects of shock and vibration can shorten the life of any connected machinery. Here is how the Steelflex grid-groove design overcomes these common enemies.



Under LIGHT LOADS
The gridmember bears only at outer edges of grooves. The long span between points of contact remains free to flex under load variations.



Under NORMAL LOADS
As load increases, the distance between supports on the grooves is shortened proportionately, but a free span remains to cushion shock loads.



Under SHOCK LOADS
Under extreme overloads, the grid-member bears fully on the grooves and transmits full load directly. The coupling remains flexible, within its rated capacity.

Why FALK Steelflex Couplings give the *finest* protection for connected machinery

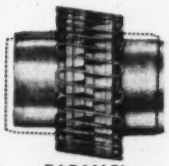
Maximum protection of connected machinery is best provided by Falk Steelflex Couplings because, thanks to their exclusive design, they overcome the damaging conditions of shock loads, shaft misalignment and vibration. How this unique multiple protection is made possible is shown at the right.

Falk Steelflex Couplings give the most economical protection, too, because they make connected machinery last longer and give better service. Furthermore, when actual coupling costs are figured per year of service, Falk Steelflex Couplings show substantial savings through their rugged all-steel construction, easy interchangeability and low maintenance requirements.

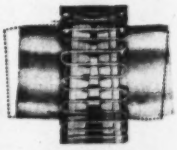
The basic Type F Steelflex Coupling—in 33 sizes to cover capacities from 2/5 through 70,000 hp per 100 rpm—meets over 90% of all industrial applications. Special or Dual Purpose Steelflex Couplings are available for problem applications. Write to Department 247 for engineering bulletin, including selection and dimension details.

...Accommodates shaft misalignment and free end float

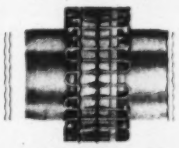
Basic maintenance procedure dictates regular inspection and correction of shaft alignment. Between inspections, Steelflex couplings provide protection by accommodating unavoidable shaft misalignment and end float. The gridmember which connects the two hubs of a Steelflex coupling is not fastened to either hub, so each hub can shift without imposing load on the other shaft.



PARALLEL MISALIGNMENT



ANGULAR MISALIGNMENT



FREE END FLOAT

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- Flexible Couplings
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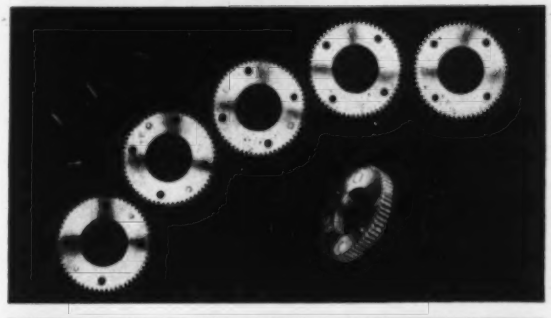

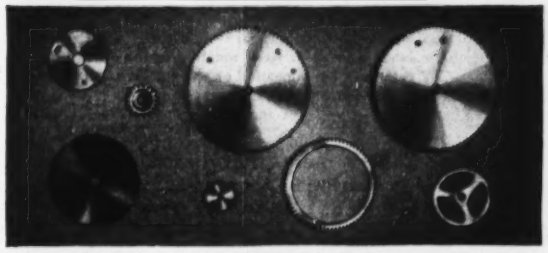

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preference points on power transmission units

Seals that are

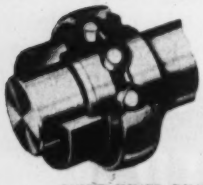
EFFECTIVE...FRICTIONLESS

The Mechani-Seal consists of two "dished" steel plates. The inner member is fixed securely in the outer ring. The outer member is pressed on the outside diameter of the inner ring.

For applications where the bearing must be thoroughly protected against the entrance of foreign matter, or where grease must be absolutely retained within the bearing, the Fafnir Mechani-Seal Bearing offers definite advantages. This is the bearing you'll find in most Fafnir Ball Bearing Power Transmission Units.

The labyrinth design of the Fafnir-originated Mechani-Seal provides an inner trap seal for grease retention and an external rotating slinger for dirt exclusion. Close, but definite clearances between various seal members permit the bearing to "breathe". What's more, they insure it against drag, either in starting or running . . . no rubbing to introduce friction . . . no wear. Seals are integral with the bearing, are not subject to fouling or misalignment, and are corrosion and rust resistant.

When you compare design features, point for point, you can readily understand why the preference is for Fafnir Ball Bearing Power Transmission Units. For more details and a complete description of Fafnir Power Transmission Units call your Fafnir Representative. The Fafnir Bearing Company, New Britain, Conn.



WIDE INNER RING BALL BEARINGS
. . . with Mechani-Seals

PILLOW BLOCKS
. . . standard and heavy series

FLANGE CARTRIDGES
. . . standard and heavy series

CYLINDRICAL CARTRIDGES
. . . standard and heavy series

MOST COMPLETE LINE IN AMERICA

An important message concerning a new –and unique– alloy steel

UNITED STATES STEEL is pleased to announce to all steel consumers a new steel which we feel sure will enable you to improve the performance, lengthen the life, and reduce the cost of industrial equipment. This new engineering material is USS Carilloy T-1 steel, which recently underwent some very severe testing in Birmingham, Alabama.

The development of T-1 steel began back in 1947, when our research people took a good look at a problem that had plagued alloy plate steel users for years. That problem was the multiplicity of compositions required to do everyday jobs. There was no one composition available that could serve a wide variety of applications—so our research people set out to develop such a steel. The steel we wanted had to possess many unusual attributes such as very high strength, unusual toughness, good weldability and excellent resistance to impact abrasion at temperatures from minus 150°F. up to as high as 900°F.

Today such a steel is a reality. It is USS Carilloy T-1 steel, which has been tested thoroughly, both in the laboratory and in actual service applications. To prove further the capabilities of this new Carilloy steel, Chicago Bridge & Iron Company and United States Steel this summer carried out a joint testing program on commercial pressure vessels built from T-1 steel. The results of these tests and their significance to all steel users are described on the next three pages. We feel sure that you will find the story well worth reading.

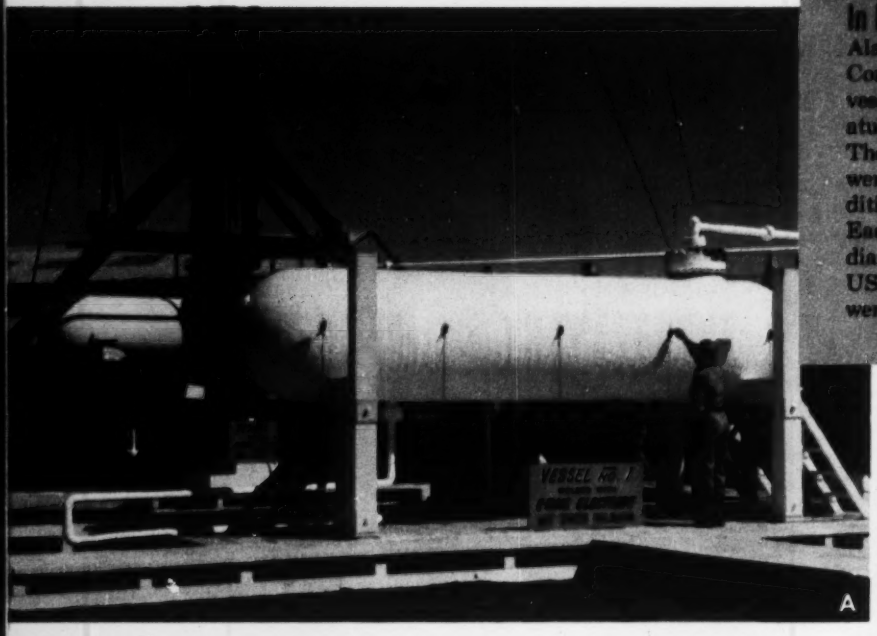
USS

UNITED STATES STEEL

Remarkable new engineering material

PROVES SUPER-TOUGH

In May and June, 1954, at the Birmingham, Alabama, plant of Chicago Bridge & Iron Company, eight welded cylindrical pressure vessels were refrigerated to subzero temperatures and deliberately tested to destruction. The vessels were all standard designs that were built under normal production-line conditions by Chicago Bridge & Iron Company. Each vessel was twenty feet long, four feet in diameter, and made of half-inch plates of USS Carilloy T-1 steel. Four of the vessels were welded without stress relieving, using



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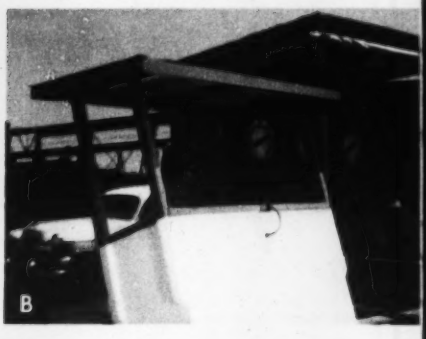
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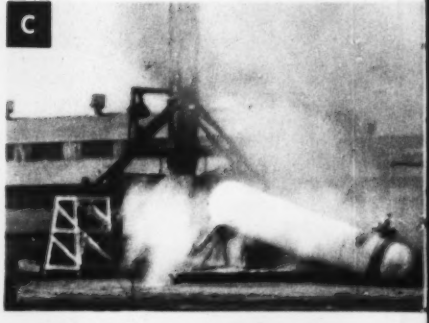

C

D

In pressure test at 38°F. below zero T-1 steel withstands stresses 3 times its design strength

This vessel, not stress relieved, was refrigerated to −45°F. Then, with a quarter inch of white frost clinging to its sides, a high pressure pump slowly chugged the pressure in the vessel up to 938 psi. At that point, the steel itself was stressed to 45,000 psi., which is one half the yield strength of T-1 steel.

The hydraulic pressure was forced still higher, to 1875 psi. At this pressure, the stress in the steel had reached 90,000 psi.—the full *nominal* yield strength. Still, every inch of the metal was sound and all welds were intact.

Now the test really came. The pump labored on, and the pressure climbed to 2,000 psi. . . . to 2500 . . . to 2850 psi. . . . then . . .

BOOM! A jet of yellow brine burst out of the vessel and shot 200 feet through the air. The vessel finally failed at a pressure of 2850 psi. and a minimum stress of 136,000 psi. on the plates. This stress is well over three times the design strength of 45,000 psi.

The temperature of the steel at the time of failure was a frigid 38 below, yet the metal showed no sign of brittle failure. Super-tough USS Carilloy T-1 did what no ordinary steel could do at such a low temperature—it stayed *tough and ductile;* in fact it actually stopped the tear from propagating any further through the vessel.

USS

UNITED STATES STEEL

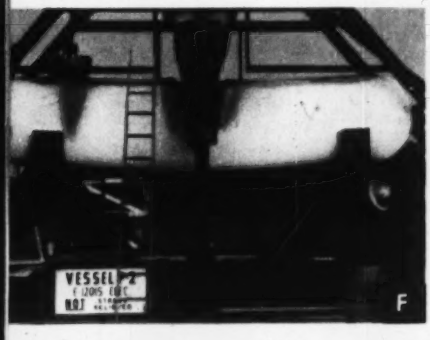
USS CARILLOY T-1 STEEL

DOWN TO 38°F. BELOW ZERO

E 12015 low hydrogen coated electrodes. The other four were welded with E 9015 electrodes and were stress relieved after welding. Two vessels of each type were given two tests: a pressure burst test for strength and ductility, and an impact punishment test for toughness and resistance to the most severe impact conditions that could be devised.

Results of these tests, described below, prove conclusively the exceptional strength and toughness of USS Carilloy T-1 steel, even at temperatures far below freezing.

E



F

G

H

Frozen steel vessel made of Carilloy T-1 survives blow from 13-ton ingot dropped 73 ft.

A steel ingot weighing 26,700 lbs. has just plummeted 52 feet and crunched on top of this test vessel (Fig. E). The ingot was traveling 39 miles per hour when it hit. It struck with an impact energy of about 1,400,000 ft. lbs., bounced fifteen feet, and crushed down again on top of the vessel.

This vessel was welded without stress relieving. It was refrigerated to 33°F. below zero. It was pressurized to 1,875 psi. equal to a stress on the plates of 90,000 psi.—the steel's *nominal* yield strength. Yet, it did not fail. The ingot left only a 7/16 inch dent in the top, with a slight bulge on either side of the dent.

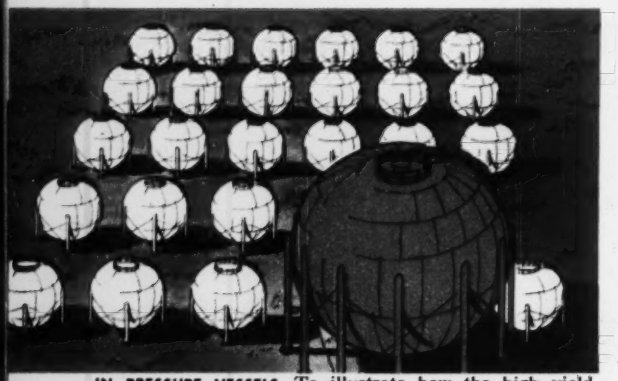
The test was repeated (Fig. F). This time the ingot was raised 73 feet, then dropped. It pounded down again on the very same spot on top of the vessel. Traveling at 46.7 miles per hour, it hit with an impact blow of 1,960,000 ft. lbs. The dent merely deepened – the steel and all welds were still intact.

Again the test was repeated (Fig. G). Now dropped from 101 feet, the 13-ton ingot ploughed into the top of the vessel at a speed of 55 miles per hour, hit with an impact of 2,750,000 ft. lbs. This time the vessel failed. But it didn't shatter. It didn't crack. It tore open like a tough piece of hickory. In other words, it failed without any signs of brittleness, even though the temperature of the steel was now minus 22°F.

In addition to this tremendous resistance to impact abuse, combined with remarkable sub-zero toughness, Carilloy T-1 steel also gives you excellent resistance to impact abrasion . . . . good high temperature strength . . . and exceptional weldability.

Turn the page to see how you can use this remarkable new steel to cut costs and improve performance in a great variety of products.

Here's where you can reduce costs with USS Carilloy T-1 steel



IN PRESSURE VESSELS. To illustrate how the high yield strength of Carilloy T-1 steel can pay off here, consider this fact: To store 25,000 bbls. of propane at 210 psi would ordinarily require 25 mild carbon steel vessels. In contrast, only *one* large vessel made of T-1 steel of the *same* thickness would do the job. This single T-1 vessel would require 1/3 less shell material, 14% less foundation concrete, 70% less welding and 84% less space.

IN STEEL MILLS. In skip cars, T-1 steel in the bottoms, sides, and bail plates lasts three times longer than steels now in use. T-1 steel also gives exceptionally long service in coke bins and chutes, in ore transfer cars, in draft lines, in conveyor chains, and crane hooks. In clamshell buckets, T-1 steel has taken heavy abuse at temperatures from 500° to 600° F. and lasted *nine times* as long as the wear resisting steel previously used.

IN EXCAVATING EQUIPMENT. The dipper stick, bail, and bucket of this big electric shovel are fabricated of T-1 steel plate. The superior strength and durability of Carilloy T-1 made it possible to increase the capacity of the bucket from 35 to 45 cu. yds.

● The pressure vessel tests described on the previous pages indicate only one of the many possible uses of Carilloy T-1 steel. For this new engineering material has advantages not only in pressure vessels and storage tanks, but it also has proved itself in power shovels, bulldozers, mining machines, mine cars, steel mill ladles, blast furnace draft lines, lift trucks—in high speed rotating machinery, in stamping or forging presses. It is being considered for use in tension members of cantilever bridges and other similar applications where tension members are involved.

With the 90,000 psi. minimum yield strength to work with, combined with extraordinary sub-zero toughness, good high temperature strength to 900° F., and excellent resistance to impact abuse, impact abrasion, and atmospheric corrosion, you can use T-1 steel to reduce the size and weight of heavily stressed parts. This cuts your shipping and handling costs, as well as the cost of material, and the cost of foundations and supports where they are needed. Carilloy T-1 steel lengthens the life of your equipment, cuts repair bills and outage time. And remember, wherever you use T-1, you can weld or flame cut it either in the shop or in the field without expensive heat treating equipment. This cuts costs still further.

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☐ Please send me your booklet "United States Steel presents T-1" which contains the full story of T-1 steel.

☐ Have your representative get in touch with me.

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USS

UNITED STATES STEEL

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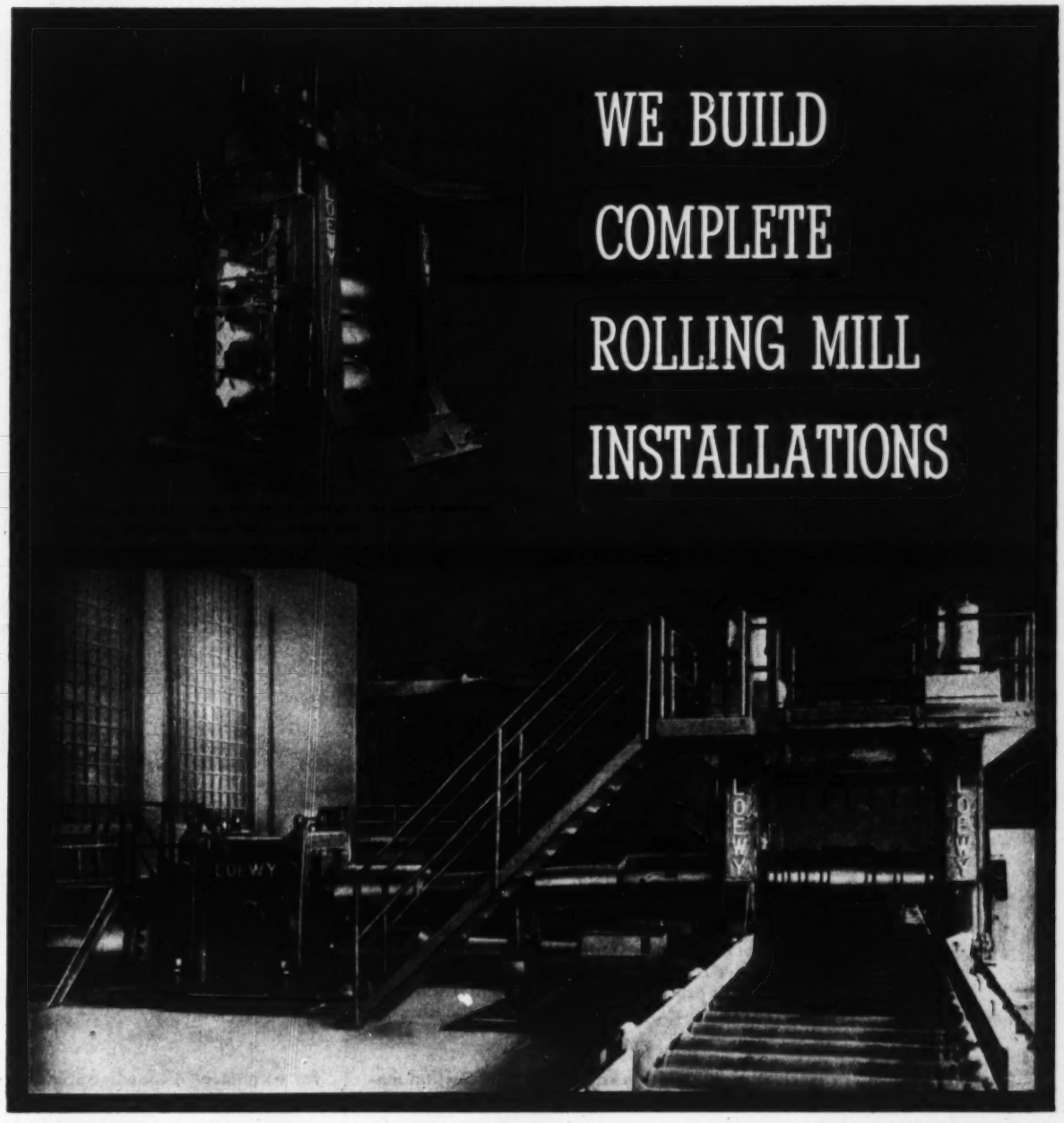

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Relief...for a production pain

Got an "ache" in your designs? Costs too high . . . production too low . . . product not competitive in price or performance?

For effective relief of production "pains," here's a suggestion. Take advantage of the practical, cost-saving application services offered by your Chain Belt District Engineer, and the outstanding performance of Chain Belt Products.

for example: A lift truck manufacturer was troubled by chain breakage and high over-all cost. His Chain Belt Man recommended a change to leaf chains which not only solved the breakage problem, but actually cut costs.

for example: A construction machinery manufacturer was experiencing considerable trouble due to premature failure of drive chains. His Chain Belt Man solved the problem with Rex Chabelco® Steel Chains designed to withstand the severe operating conditions.

for example: A manufacturer of packaging machines wanted an improved method of handling units through his machines. His Chain Belt Man recommended TableTop® Chain, a chain that provided a smooth, steady, tip-free conveyor, as level as a metal belt.

If your design "pains" involve driving, timing or conveying, your Chain Belt District Engineer can help you. From the complete Chain Belt Line of chains, sprockets, attachments and roller bearings, he can recommend the one best choice for your needs. Try him. Chain Belt Company, 4765 W. Greenfield Ave., Milwaukee 1, Wis.

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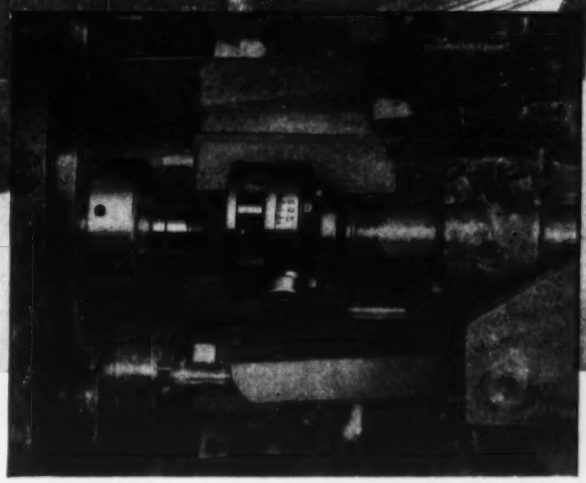
3¼ miles of rolled threads...



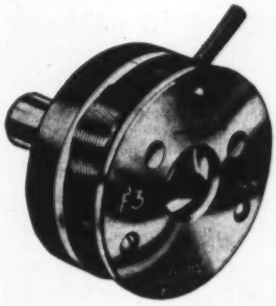
and the National Acme "FETTE" thread rolls are still going strong

Piece after piece—at the rate of 1500 an hour—these brass end rings roll off a 9/16" RA-6 Acme-Gridley automatic. And with more than 627,000 pieces in the bin, the National Acme "FETTE" head is still rolling identical threads with the same set of rolls.

You don't have to figure it out. When you use these self-opening thread rolling heads you *know:*

- **threading speeds will be the same as high speed steel turning tool speeds**
- **threads will be more accurate, stronger and smoother by this "cold-forming" rolled thread process**
- **trouble-free performance of National Acme "FETTE" heads means uninterrupted production—less down time**
- **more "mileage" with a set of rolls means lower cost per piece**

Check the advantages of FETTE heads for your threading jobs — send sample or print for our recommendations, or ask our representative to call.



National Acme "FETTE" Self-opening Thread Rolling Heads are used on automatics, turret or hand lathes, threading machines, drill presses, and other types of vertical and horizontal machines.

Design simplicity and rugged construction insures long life of head and rolls. Made in revolving type in capacities 7/16" to 1"; non-revolving type 1/16 to ¾".

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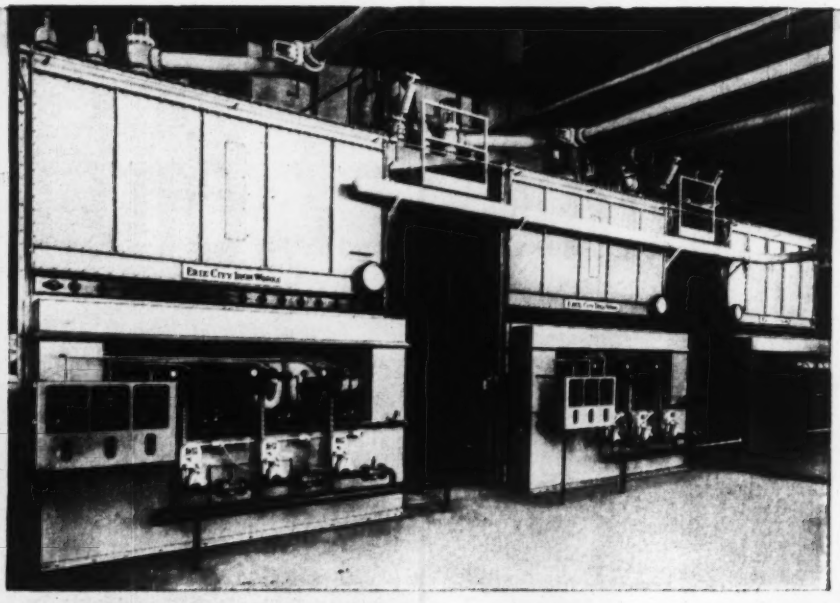
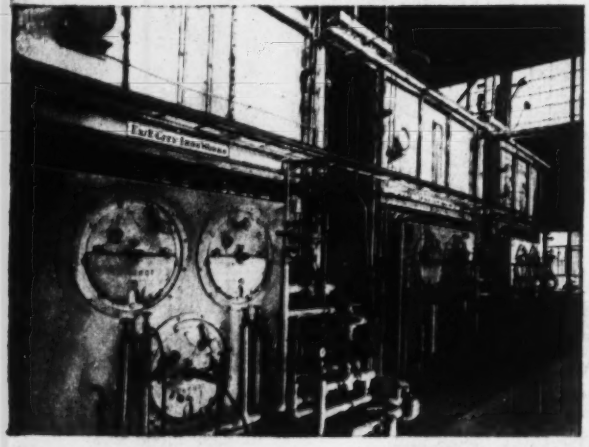
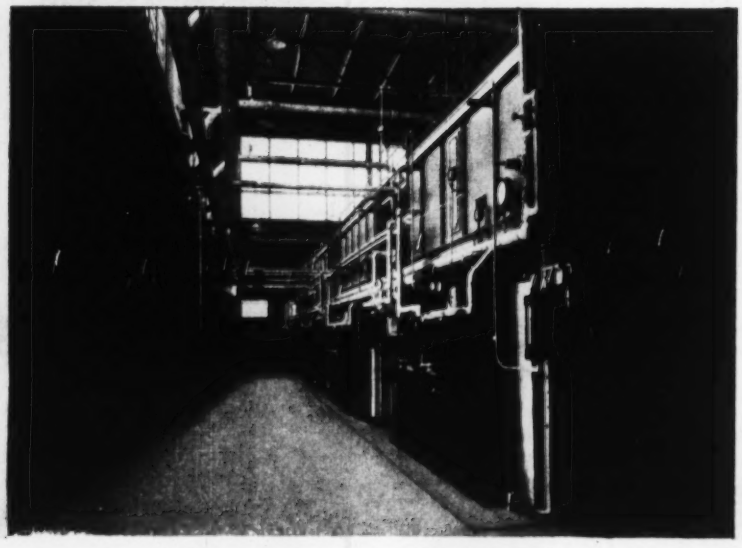


3—Erie City VC's—each 27,000 pounds of steam per hour—oil and gas fired.
A Midwest Capitol Heating Plant

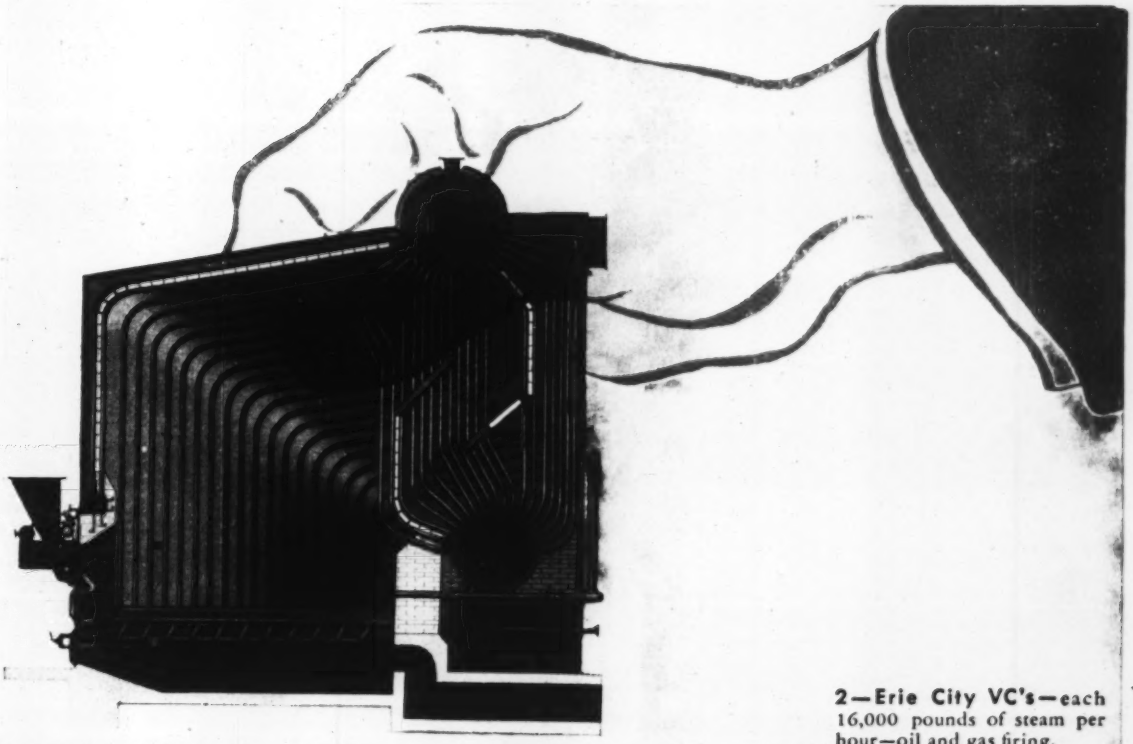
MODERN USE VC's



3—Erie City VC's—each 22,000 pounds of steam per hour—oil and gas fired.
A California Institution



4—Erie City VC's—each 33,000 pounds of steam per hour—oil fired.
U. S. Government



2—Erie City VC's—each 16,000 pounds of steam per hour—oil and gas firing.
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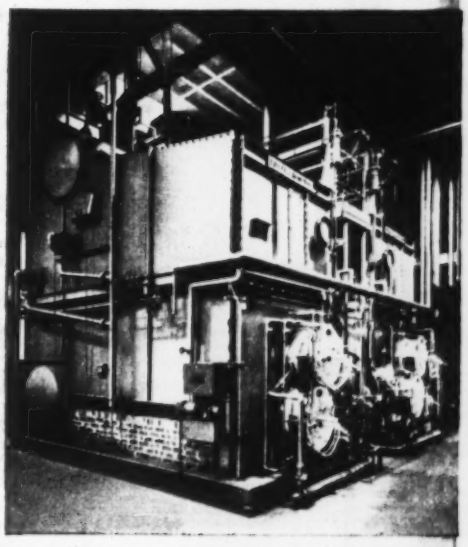
● **ECONOMY OF INSTALLATION**
Erie City VC's are built in standard sizes and are compact; utilizing every available cubic foot of space either as furnace volume or as space for heat absorbing tubes.

● **ECONOMY OF MAINTENANCE**
These boilers are completely steel encased, have water cooled furnace walls, and ring flow circulation, giving the user a clean, easily maintained boiler room and eliminating costly refractory repairs.

● **ECONOMY OF OPERATION**
Multiple VC installations insure peak efficiency regardless of load condition. Adaptability to all methods of firing permits use of readily available fuels.

Modernize your power plant with the installation of Erie City VC boilers. Moderate steam users everywhere are finding it economical. Bulletin VC-5 gives a full description of the many advantages of this unit.



You can depend on Erie City for sound engineering

ERIE CITY
114 Years in Steam Generation

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UNDERFEED AND SPREADER STOKERS • PULVERIZERS

You're looking at the biggest pressure gauge development since the "Recalibrator"

Here is one of those typically MARSH developments . . . the kind of pioneering step you have come to expect from the organization that originated the basic advances in pressure gauges culminating in the exclusive "Recalibrator." This latest Marsh development is known as the

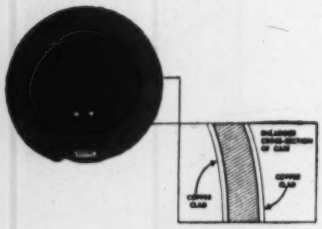
NEW MARSH *"Conoweld"* TUBE

This time we have made the best part of the best Marsh gauge still better. We have gone into the part that actually does the work — the socket and tube — and have made it permanently leak-tight from inlet to tip of tube.

We have done this by fusing the tube into the socket and the tip to the tube so that the whole assembly is truly *one piece*. The photo of one of the sockets sawed in half shows the perfect fusion of the vital joint. Tests and photomicrographs prove the perfection of the fusion.

Developing the fusing process called for extensive research. The method as finally perfected — the "Conoweld" process — involves first fusing the tube to the socket and end-piece; then tempering the tube to required resiliency.

Yes, it is these dramatic departures from beaten paths that have achieved leadership for Marsh gauges and are ever increasing that leadership. Ask for latest information covering gauges for all services.



Another first for Marsh

Here is a case in keeping with the "Conoweld" tube. Another recent Marsh development, it is called the

New *Marshalloy* Case

It is a copper-clad wrought steel case of boiler plate thickness, four times as strong, and one-third lighter than conventional cast iron cases. Copper surface makes it as non-corrosive as a plastic or die-cast case. Handsome, corrosion-resistant, satin black enamel and Marsh safety blow-out plug are the finishing touches.

MARSH INSTRUMENT CO. *Sales affiliate of Jas. P. Marsh Corporation* Dept. 29, **Skokie, Ill.**

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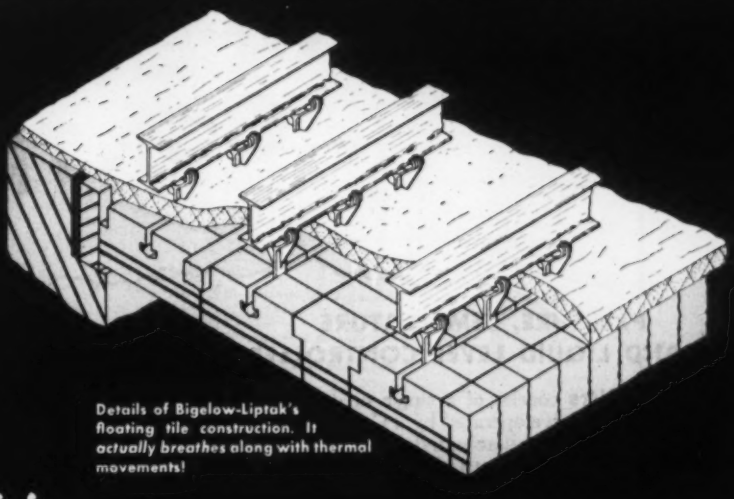
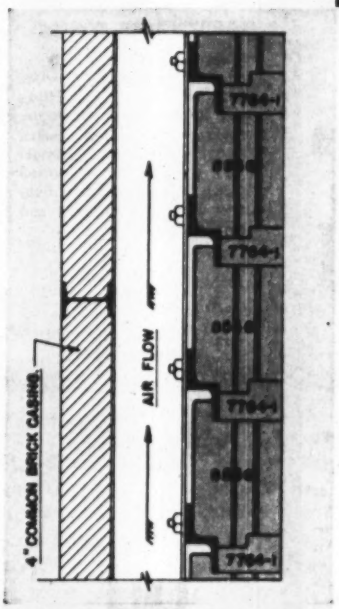
"THE STANDARD OF ACCURACY"

MANUFACTURERS OF THERMOMETERS • WATER REGULATING VALVES • SOLENOID VALVES • HEATING SPECIALTIES

Suburban Detroit's New Incinerator . . . . WILL BE TOUGHER THAN BLAZES!



Details of Bigelow-Liptak's floating tile construction. It *actually breathes* along with thermal movements!



Cross section of B-L's arch construction. Note how heavy, heat-resisting castings support the tile.

City planning engineers and consultants will be vitally interested in the fact that Bigelow-Liptak's unique, unit-suspended design for furnace walls and arches makes incinerators "tougher than blazes" too.

Proof of that fact lies in the many B-L installations which dot the country. Right now, in suburban Detroit, Michigan, construction is underway on a large incinerator which features the B-L design.

In a nutshell, unit-suspended construction provides longer, trouble-free life at a lower, overall cost.

Here's why:

1. Each tile is individually supported—there's no "stacked up" burden caused by the ones above it. Thermal expansion is confined to individual tile. Mechanical spalling caused by pinching, buckling, etc. is eliminated. That adds up to no cumulative loading or expansion.
2. If repairs ever become necessary, any small section of tile can be removed and replaced without disturbing adjacent areas. This cuts the size of the repair job as all other areas—above, below, at the sides—need not be touched.

Remember: you'll pay less in the long run. Countless installations in boiler houses, oil refineries, metallurgical furnaces—wherever heat must be controlled—have proven that fact. Write for information—today.

BIGELOW-LIPTAK *Corporation*

and Bigelow-Liptak Export Corporation

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PRESSURE, TEMPERATURE AND LIQUID LEVEL CONTROLLERS

Leslie Controllers consist of a single or double seated diaphragm control valve operated by a Control Pilot. The latter is an air, water or oil actuated device that produces a variable loading pressure to the valve diaphragm in response to a pressure, temperature or level change in the controlled medium. Controllers are used for any one or any combination of the following conditions:

★ When an exactly controlled level, pressure or temperature is required.

★ When power is needed to assure automatic valve opening after prolonged, tight shut-off.

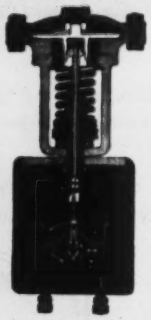
★ When power is needed to operate single-seated valves under high pressure drop.

★ When the available fluid pressure differential doesn't supply enough power for self-operation.

★ When extreme pressure reductions are necessary (i.e. 600 reduced to 10 psi, 900 to 2 psi, 2150 to 5 psi); all can be handled in one step.

★ When fluid contamination requires the simplest type regulating valve for dependable operation.

★ When operation from either a nearby or remote control station is desired.

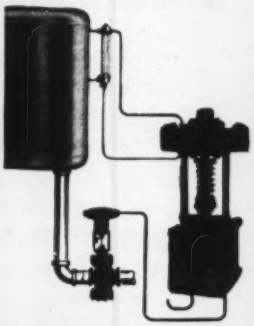


Control Pilot
Type PD

LESLIE
CONTROL PILOTS

Simple mechanical device employing constant supply of clean air, gas, water or light oil at 20-22 psi to produce a variable output or loading pressure of 0-20 psi in response to a level, pressure or temperature change applied to operate a control valve or power cylinder controlling fluid flow.

SEND FOR BULLETIN 5303



Floatless Level Control
Type UA-1

LESLIE
FLOATLESS LEVEL CONTROL

Provides accurate control of liquid level (plus or minus 1" water column). Eliminates problems caused by troublesome linkages, torque tubes, floats and stuffing boxes. Simple design provides steady, positive, precise control even under difficult conditions. Consists of Level Control Pilot and diaphragm control valve.

SEND FOR BULLETINS
5303, 5304, 5305

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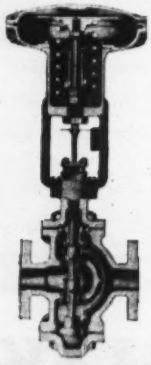
DIAPHRAGM CONTROL VALVES
(Double Seated)

Flow-line contoured body for high capacity, low pressure drop. Standard ISA face to face dimension in cast iron, cast bronze and cast alloy steels. Renewable, self-aligning guides. ¼-10". To primary service rating of 600 psi—950° F. flanged, ring joint and welding ends.

SEND FOR BULLETIN 5305



Diaphragm Control Valve
Double Seated Class DV

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DIAPHRAGM CONTROL VALVES
(Single Seated)

Control flow of steam, liquid, air or gas. Tight shut-off. Operated automatically by air, water or oil pressure supplied from a Control Pilot or from a loading device such as LESLIE Air Loading panel. Available in unbalanced or fully balanced types, ¼-10" in cast bronze, cast iron and cast alloy steels. Primary service ratings to 2500 psi, 1000° F.

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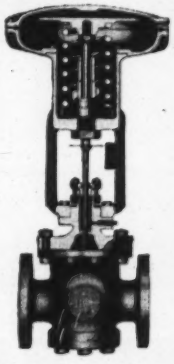

Diaphragm Control Valve
Single Seated Class DL-1

5150

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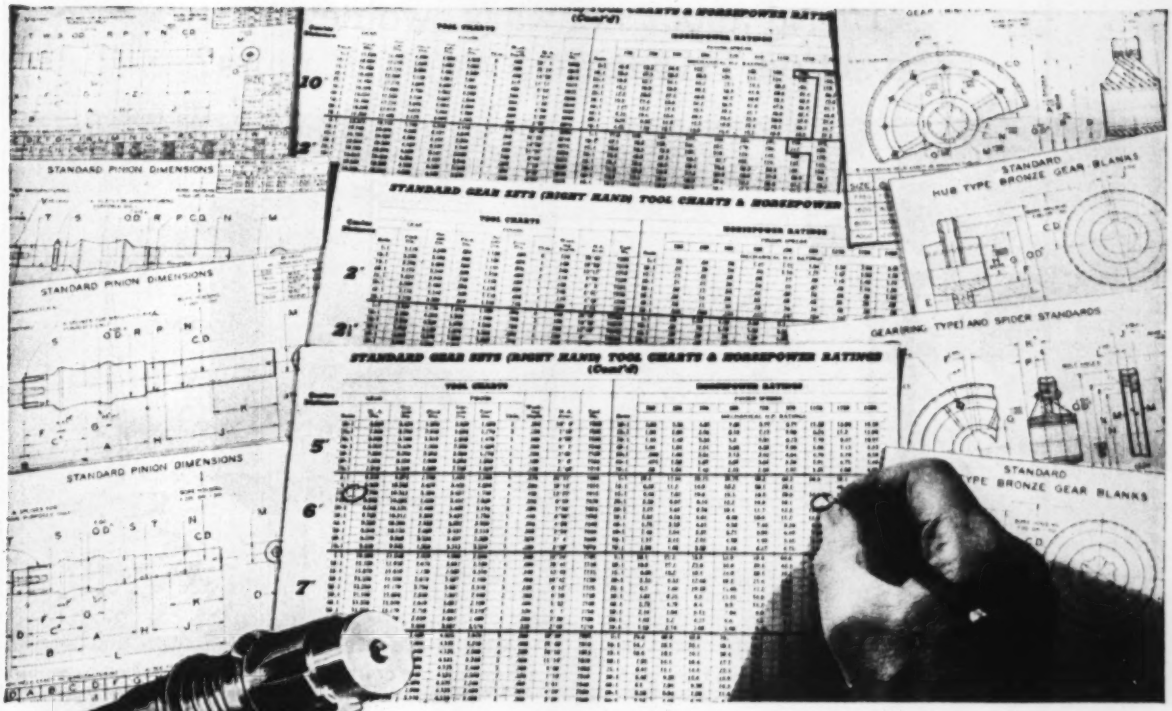
SINCE 1900

"STILL FAR AHEAD IN QUALITY AND PERFORMANCE"

LESLIE CO., 287 GRANT AVENUE • LYNDHURST, NEW JERSEY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STANDARD GEAR SETS (RIGHT HAND) TOOL CHARTS & HORSEPOWER
STANDARD GEAR SETS (RIGHT HAND) TOOL CHARTS & HORSEPOWER RATINGS (Cont'd)
STANDARD HUB TYPE BRONZE GEAR BLANKS
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plus **this vital feature**

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Ask for Catalog No. 700

Specify STANDARD Cone-Drive Gears and get all these advantages

Lower Cost—due to smaller size of gears and housings, mass production of worm and gear blanks, etc.

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Division, Michigan Tool Company
DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS
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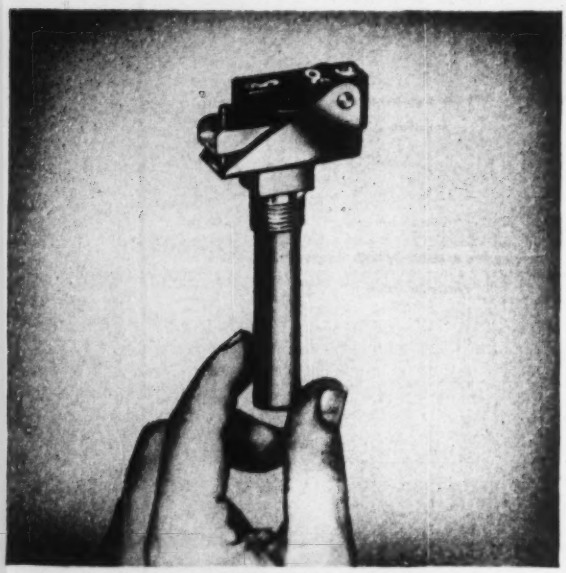
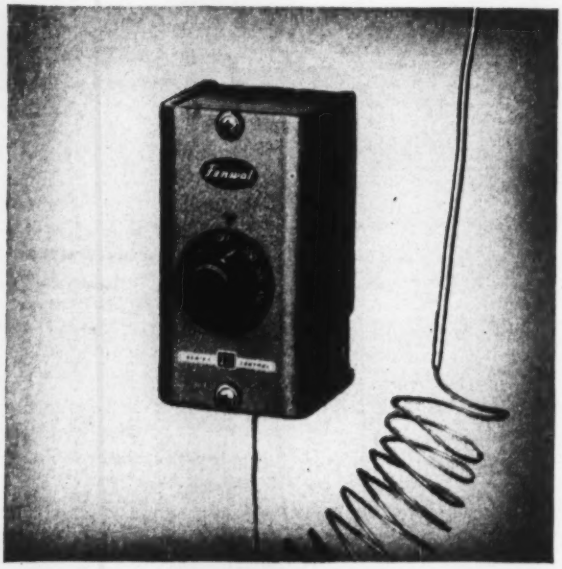
Heard about Fenwal's two new snap-action THERMOSWITCH® units?



1. FOR LOCAL CONTROL. Series 20,000, local bulb type, is an important advance over conventional bellows-actuated temperature controls. Bellows arrangement in the liquid-filled bulb permits sensitivity over virtually the entire area of the shell, greatly reducing lag. Temperature range: 50° to 300°F. Load rating: 20 amps at 120V AC.



2. FOR REMOTE CONTROL. Series 511, remote bulb type, includes a long capillary tube connecting the probe at the point of temperature change. Like the Series 20,000, it provides the advantages of maximum sensitivity and instant actuation of the snap-switch. Temperature ranges: 60° to 250°F, or 200° to 550°F. Load ratings: 25 amps at 250V AC; 35 amps at 125V AC.

3. FENWAL DEPENDABILITY IN BOTH. These bellows-type snap-action THERMOSWITCH units are typical products of Fenwal research, featuring sensitivity, stability and quick, positive action. Precision-built for uniformity, ruggedness and dependability, they are valuable additions to the expertly engineered, widely useful THERMOSWITCH line.

4. SEND FOR DATA BULLETINS. Get complete facts on the new Fenwal snap-action THERMOSWITCH devices, now. We'll be glad to send you comprehensive bulletins on either or both types, or to discuss any problem involving temperature control or detection. **Write Fenwal Incorporated, 511 Pleasant St., Ashland, Mass.**

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Electric Temperature Control and Detection Devices

SENSITIVE...*but only to heat*

The barrel does the bearing job better

In the fight against friction, engineers are using a new kind of bearing . . . a bearing built with barrel-shaped rollers.

Developed by Hyatt, the Barrel Bearing is "dual-purpose"—it takes both radial and thrust loads. But—and this is the important difference—unlike *ordinary* dual-purpose bearings, the Hyatt Barrel *operates at full load-carrying capacity under conditions of misalignment!*

Because of this self-aligning feature, loads on the Barrel Bearing are always ideally distributed over large areas of contact between races and rollers, with greatest load concentration at the strongest part of the rollers—at their major diameter. Roller ends cannot be overloaded.

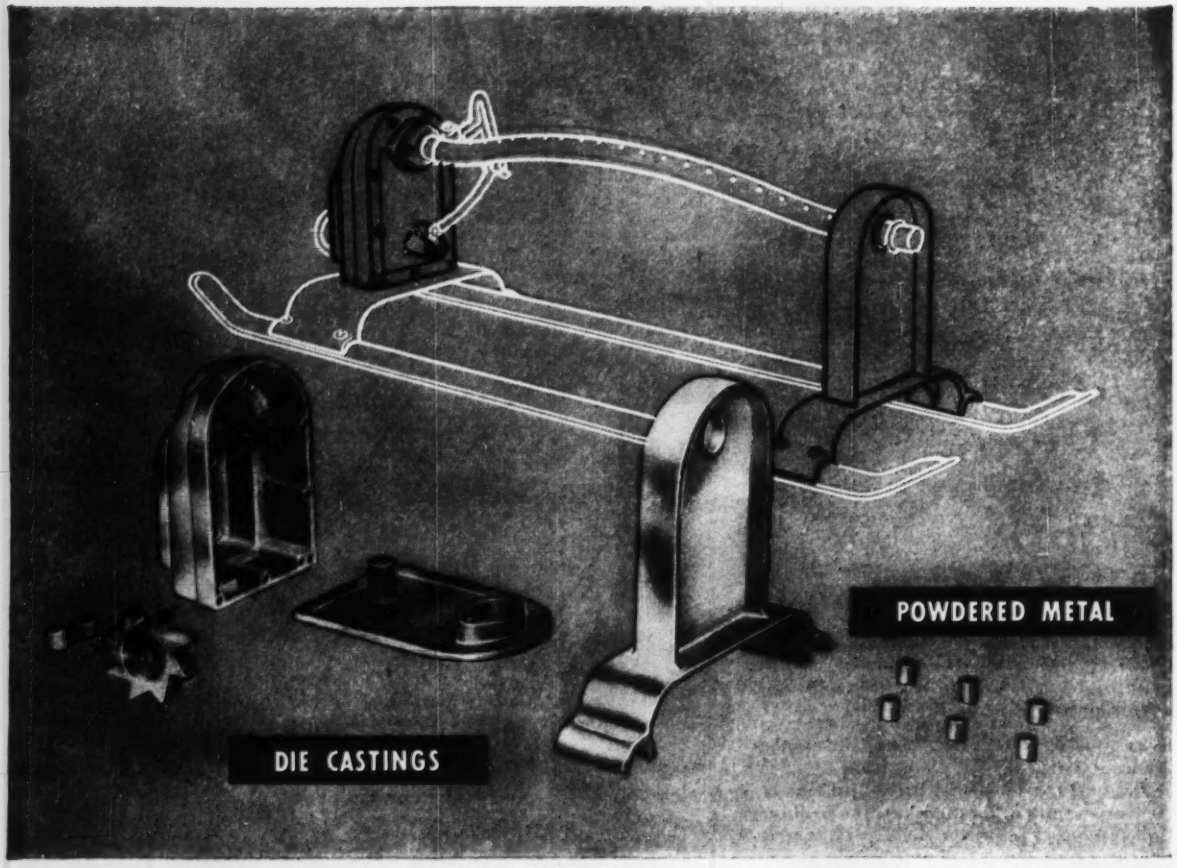
But that's not all. The barrel shape of the rollers combines low rolling friction with high load-carrying capacity—making the Barrel Bearing ideal for a wide range of applications. And here's the clincher: this superior bearing is far less costly than you'd expect—thanks to a new manufacturing process used only by Hyatt.

Does that cover it? You might think so, but it doesn't. There isn't enough space on this page to tell you everything about this new bearing. For full information, write to the address below.

HYATT ROLLER BEARINGS

STRAIGHT | BARREL | TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.



PARKER USES 2 MEANS TO Lower Cost END

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Low cost—consistent with high quality—was the primary objective in producing important component parts for the popular lawn sprinkler made by Eastern Machine Products Inc. Parker gained this objective by making the end bracket, actuator housing, crank, and water wheel of aluminum die castings. The bushings inside the housing are bronze alloy sintered metal. The end result: component parts that meet every specification at lower cost.

This example emphasizes an important point about Parker service. No matter what your requirements in either die castings or powdered metal, Parker has the skill, experience and facilities to provide either or both. This undivided responsibility has saved money—and solved problems—for many users. Your problem may be one that Parker can solve in like manner. Just call the nearest Parker sales engineer listed at the left.

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PARKER **ALUMINUM and ZINC *die castings***

NOW Leakproof V-rings

Unique revolutionary design now makes possible, for the first time, a split V-ring packing that is really leakproof in operation . . . foolproof to assemble:

LINEAR VEE-DAM RINGS

PREVENT LATERAL LEAKAGE

Smaller abutments on the outside shoulder edge of the ring, staggered in relation to the internal dams, prevent lateral leakage and also provide stabilizing support.

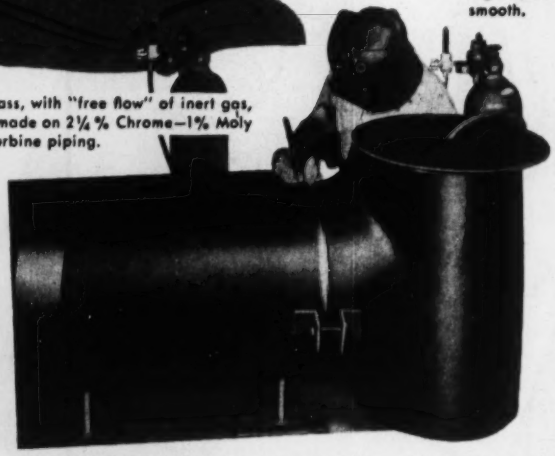
LINEAR VEE-DAM Rings last longer, because they seal perfectly with minimum gland load. We're molding VEE-DAM Rings, in a choice of fabric-reinforced elastomers, individually engineered to your needs. Write or call for full information now!

LINEAR

INERT GAS TUNGSTEN ARC-WELDING ON HIGH-TEMPERATURE, HIGH-PRESSURE PIPING?

It's More a Matter of Skill Than Inert Gas Back Pressure

Root pass, with "free flow" of inert gas, being made on 2¼% Chrome–1% Moly steel turbine piping.



Inside bead surface of root pass on 2¼% Chrome–1% Moly steel turbine connection produced by P.P.&E. inert gas tungsten arc-welding is uniform and smooth.

Typical external surface of root pass produced by skillful inert gas tungsten arc-welder.

Inert gas tungsten arc-welding is one of many operations involved in the fabrication of high-temperature, high-pressure piping. Like the others its success is not assured by a single factor, but comes as a result of long experience with all manufacturing techniques and service requirements of power piping.

Simply protecting the internal surface of the root bead with inert gas under "control" does not take the place, for example, of skillful welding.

Pittsburgh Piping's process provides an inert gas shield against the atmosphere on both internal and external surfaces of the root pass. This procedure, combined with other P.P.&E. techniques, eliminates need for backing rings and double butt welding, and produces a sound, clean joint having a remarkably uniform root bead of correct internal contour.

Applicable to all types of power and process piping—inert gas tungsten arc-welding is another of the many advanced P.P.&E. techniques used in producing all types of power piping —as small as control lines, as large as steam mains.

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PP-5

4500 per hour per machine!

You can't beat Revere Free-Cutting Brass for speed

The mounting nuts shown here are made by the Fischer Special Mfg. Co., Cincinnati 6, Ohio, out of Revere 9/16" hexagon Free-Cutting Brass Rod. Output is 4500 per hour per machine. This phenomenal rate of production is due to special adaptations of standard machines according to Fischer designs and the high quality of Revere Rod. These two important factors enable Fischer to compete price-wise with nuts produced by other methods.

Fischer nuts are chamfered and countersunk on both sides, have no burrs, and are made in sizes from 1/8" to 1-1/16", in various designs, such as hexagon, cap, thumb, spark plug terminal, lighting fixture. As a further indication of the efficiency of the Fischer operation it can be reported that during 1953 the company averaged 244,897 pieces per running hour.

If you machine brass, look into the virtues of Revere Free-Cutting Brass. See the nearest Revere Sales Office.

FISCHER WAFER or mounting nuts, made from Revere 9/16" Free-Cutting Brass Rod at a rate of 4500 per hour.

Revere Free-Cutting Brass Rod has speeded production for many firms, and saved them money.

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Conquers Heat, Erosion and Corrosion. Stainless steels containing nickel lengthen life expectancy of various components used in severe service. For instance, Diesel engine turbocharger rotors. Some rotors operate at from 12,500 to 21,000 r.p.m., and at temperatures upward of 1000°F. The rotor comprises a slotted disc of chromium-nickel stainless steel, with inserted blades of the same material . . . to take the brunt of attack in converting heat into mechanical power. Type "19-9" stainless, containing molybdenum and tungsten additions, is used to make sure of high tensile strength and low creep at the high temperatures encountered. And a somewhat similar austenitic chromium-nickel stainless steel . . . 18-8-S-Mo . . . is used for turbine nozzle blades

STAINLESS PROVIDES THE ANSWERS . . .

Thousands of designers and engineers have found austenitic chromium-nickel stainless steels to be the key to new high standards of product performance and minimum operating costs. You, too, may find that a stainless steel containing nickel will help solve *your* metal problem.

1. At Elevated Temperatures

Stainless steels of this type possess the two essential qualities for successful use at elevated temperatures. By virtue of the chromium content, and assisted by the nickel content, they have outstanding resistance to scaling and oxidation. The nickel content also results in high creep strength and stress-to-rupture properties. Combined, these properties permit use of chromium-nickel stainless even in thin sections required for lightweight design.

2. At Sub-Zero Temperatures

Experience has shown that unalloyed steels become embrittled rapidly as temperature is lowered below normal. Nickel is by far the best alloying element to prevent brittleness. At sub-zero temperatures, chromium-nickel stainless steels provide unsurpassed impact values. These steels retain such a high level of toughness that they are known to be useful at temperatures as low as —400°F. and possibly even lower.

3. Under Corrosive Conditions

Selection of exactly the right alloy for your specific needs may be made from some thirty alloy steels qualified to carry the family name "Stainless." By virtue of their strength and resistance to attack by chemicals and atmospheres over a wide range of concentrations and temperatures, these austenitic chromium-nickel steels assure not only longer life of the equipment and purity of product, but also permit decrease of bulk and deadweight without sacrificing safety.

4. Where Erosion Is A Problem

Chromium-nickel stainless offers the utmost in resistance to erosion and cavitation. By cold working, it is possible to increase the tensile strength to as much as 300,000 psi. When subjected to erosion, the erosive media work hardens the surface and, correspondingly, curbs the attack. This resistance to erosion combined with corrosion resistance results in prolonged life for equipment made from the chromium-nickel stainless steels.

5. Use *Stainless* To Meet Complex Requirements

Utilize the unique combination of properties provided by chromium-nickel stainless steels when designing new products or improving old ones. You can draw, spin, forge, weld, solder, punch, shear or bend chromium-nickel stainless steels. Leading steel companies produce these austenitic alloys in all commercial forms. A list of sources of supply will be furnished on request

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Volume 76 • Number 11

NOVEMBER 1954

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World's tallest television station tower . . .

. . . is shown nearing completion recently in Oklahoma City, Okla. The triangular 1572-ft transmitter for station KWTV is 12 ft on a side up to the 1420-ft level. From there it tapers to the base of the antenna. The first section of the 1,323,392-lb tower was hoisted into place on June 14. Additional 30-ft sections were lifted into place by high-strength hoisting cables and wire-rope slings made by the Hazard Wire Rope Division of American Chain and Cable Company.

Editorial

MECHANICAL ENGINEERING

November, 1954, Vol. 76, No. 11 . George A. Stetson, *Editor*

Education for What?

For more than two thousand years man has cherished the hope that the ills of the world would be cured by education. Today we cherish the same hope; for if we cannot assert that the ills have been cured, at least in retrospect we can discern amelioration of them. Bit by bit, each generation has added to man's store of knowledge. Each generation has reviewed and tested the knowledge it has inherited from the past. Each generation has discarded what it has found to be false or has offered fresh interpretation of what might have been the truth if it had been properly understood. And more recently, each generation has perfected the means by which truth is sought out, tested, and applied for the benefit of man's institutions, for his material well-being, and for his cultural and spiritual growth. By education this vastly expanding body of knowledge is communicated from one generation to another to form the basis for fresh advances, and conditions are created in which ever-greater numbers of people come under the influence of processes of formal education.

The early settlers of New England established publicly supported schools which all children could attend because it was obvious to them that a self-governing people must be able to read. To provide teachers, they established colleges. Hence, when the opportunity for self-government arrived, they were able to seize it with confidence and success. In an atmosphere of individual and political freedom, education paid off. And through science and engineering it is now paying off in the rapid advances in business, commerce, and industry. Today our nation discovers that its very existence may depend on how successfully we may be able to keep in advance of other nations which threaten our peace and security.

This great race in which we and our antagonists are engaged is in a sense a race in education, using that term in its broad meaning. It is fairly obvious that without proper education we should have no scientists and no engineers. It is almost equally obvious that our political, religious, industrial, and business leaders require a high degree of education. But the people who are to be safeguarded, benefited, and led, must be educated too if they are to preserve their liberties and make wise decisions in matters which affect their welfare. Education is essential to the individual and to society.

The foregoing sketchy comments on education were occasioned by two articles printed in this issue, one on engineering education in Russia, and the other on basic conflicts in engineering education in the United States. Here are two large and powerful nations with sharply different social objectives, different concepts of the value and dignity of the individual, and different political philosophies and methods of government, yet each is pinning its hopes of survival on education and the rapid development of science and engineering. Is it too much to hope that education, which has made men free, will continue to advance their freedom?

Paid Your Dues?

This magazine is the most frequent and regular means of contact of The American Society of Mechanical Engineers with all of its members. Surveys have shown that the news section is high on the list of departments which regularly attract the attention of readers. Through the ASME News, members keep in touch with the major activities of the Society, such as the meetings and conferences to be held and the papers scheduled for presentation, the availability of new publications issued from time to time in considerable number, the official actions of the Society's governing body, and a host of other items.

Anything that interrupts this regular monthly contact between the Society and one of its members not only cuts off this flow of information but also the feature articles, the timely and interesting material which is assembled in "Briefing the Record," the digests of ASME technical papers available for purchase, and other features which the magazine has to offer.

Aside from the occasional interruption caused sometimes by a member's change of address, the most serious one is brought about, usually through oversight, when a member's dues remain unpaid for a period of three months. The ASME By-Laws state: "At the first meeting in the calendar year the Secretary shall submit to the Council a list of members whose dues have remained unpaid for three months. The Council may order the withholding of the publications for such delinquents."

ASME dues for the fiscal year 1954-1955 were payable Oct. 1, 1954. Are you one of those who has forgotten to pay these dues? If so, this is a reminder. Don't allow an interruption of your contact with your Society to occur. Don't be one of those who will wonder early next year why the mailman has not delivered your copy of Mechanical Engineering.

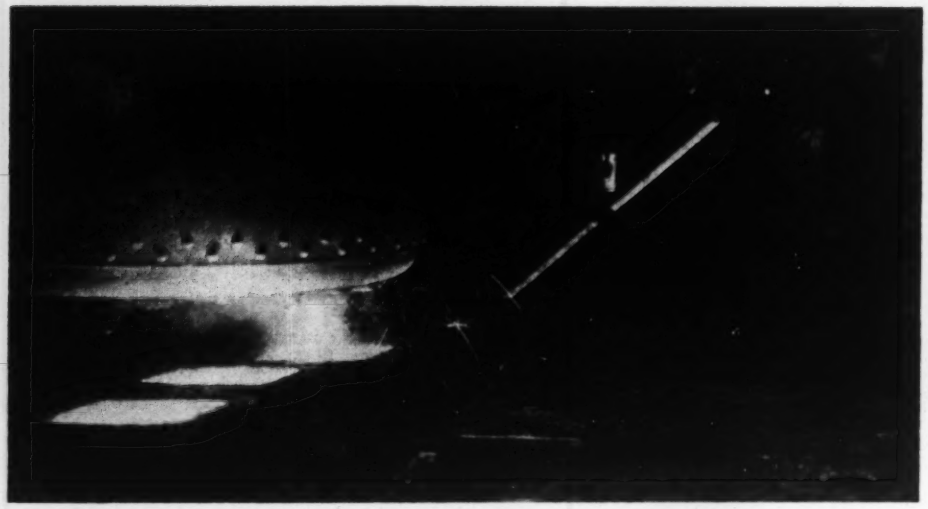

Fig. 1 Pouring ingots by hand results in a safety hazard from the splashing of hot steel

Engineered Safety

. . . or how the engineering approach is solving tough safety problems in industry

By John L. Young

Vice-President, Engineering, United States Steel Corporation, Pittsburgh, Pa.

ONE of the early steps in the organization of the industrial safety movement was taken December 8, 1908, when John C. Reed, President of the Association of Iron and Steel Engineers, appointed a safety committee. The safety programs developed by this and subsequent committees grew to be an important feature of association meetings. The officers of the association, soon recognizing that the safety movement should be spread throughout all industries, decided that a separate organization was essential.

Launching the Safety Movement

Invitations were issued to attend a co-operative safety congress to be held in Milwaukee, Wis., in October, 1912. The result of that congress was the formation of the National Safety Council. Thus it is interesting to note that engineers were responsible for launching the national safety movement.

In the 1912 to 1915 period, unfortunately, there were many men in the steel industry, as a whole, who held a conviction that steelmaking processes were inherently dangerous, for many so-called natural reasons.

During the next few years, in spite of queer mixtures of enthusiasm, discouragement, irritation, and amusement, some real progress was made. By 1923 the U. S. Steel safety program had spread to the entire steel industry. The idea had popular appeal and public acceptance, and somewhere along the line the National Safety Council devised a score sheet whereby companies and industries were given performance ratings in accident prevention. Also, U. S. Steel came forward with a slogan "Safety First" that was promptly adopted by industry all over the country.

Since then, the management, the operators, the workmen, and the engineers of U. S. Steel have worked together as a team to better the safety record. Last year the accident-frequency rate among U. S. Steel's steel-producing employees was less than two injuries per million man-hours worked. That was 51 per cent lower than the National Safety Council's rate for the entire steel industry in 1952.

A short time ago a notice came across the author's desk that the Inspection Department at U. S. Steel's

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Ellwood Works had reached a goal of 20 years without a lost-time accident. The record stood at 7305 days and 8,600,000 man-hours.

Planning for Safety

Safety consciousness and accident prevention must start in the creative stages of design and manufacture. The design engineer must incorporate in the designs the latest thinking and best practices for worker protection. Never forget that it is far better to include in the original facility design all of the practical safeguards that should be there. Those added later not only cost more money but sometimes can be done only at the expense of over-all operating efficiency.

Remodeling an existing plant offers opportunities for improving safety and health considerations. It is estimated that 75 per cent of the industrial buildings in this country are more than 25 years old. Layout, ventilation, lighting, and other facilities may and can be improved without prohibitive expense.

The design of safety into mill equipment falls into two general categories:

1 Guarding the point of operation.
2 Guarding power-transmission machinery.

Point of Operation

The first of these, "point of operation," is usually the most difficult owing to the many variances and complexities of operations in our steelmaking processes. A rather new example is the auto-pour for teeming, or pouring, ingots. Fig. 1 shows the old method of hand operation that has been in regular practice almost since the beginning of the steel industry. The splashing hot steel was a safety risk.

Fig. 2 is the newly developed auto-pour for teeming ingots. A hydraulic cylinder actuated by remote push-button control operates the stopper, allowing the operator to place himself a safe distance from the hot metal. Electric controls and electronics, in general, are being used more and more for both automatic and/or remote-control operations in the modern steel mill.

In most installations several points or combination of points must be considered, all requiring special analysis dependent upon the particular operation involved. Mechanical feeding devices or devices that prevent operation where the operators' hands could be in the danger zone should be provided. Enclosures, covers, and barricades and, where practical, interlocking guards which render the equipment inoperable when they are removed, are among safety provisions in the modern plant.

Overhead moving objects are a problem in the steel industry. The electric overhead cranes are constantly moving ladles, ingots, finished and semifinished product, and mill rolls. Various warning devices are employed and the movement of materials planned, but moving overhead or floor-level objects are still subjects that must be given a lot of thought.

Hazards at point of operation often provide a real challenge to the ingenuity of the designer to develop a simple, economical, foolproof arrangement. Usually the solution lies in the application of one or more tried and proved methods.

Color or painting for a purpose has been found very helpful as a safeguard. The standardized color code is a great aid. Highlighting the point of operation with light tints that stand out against a darker background enables the operator to watch the work with less eye effort.

Guarding Power-Transmission Machinery

The guarding of power-transmission machinery, although of equal importance to guarding the point of operation, is not as difficult or involved. The types of guarding have become more or less standardized by all designers and equipment manufacturers. That does not mean we can afford to be complacent. We cannot risk a designer's error of omission. Further than that, we always should be interested in improving the design of the guards themselves, particularly to make them more adaptable, accessible, and obvious, so that we can minimize the chance of "missing guards" after a maintenance operation. In many cases final design or modifications are required during or after erection of equipment in order to get the safest arrangement.

Safety technique was developed originally by trial and error and proved by results achieved.

It can "safely" be said that continued improvement

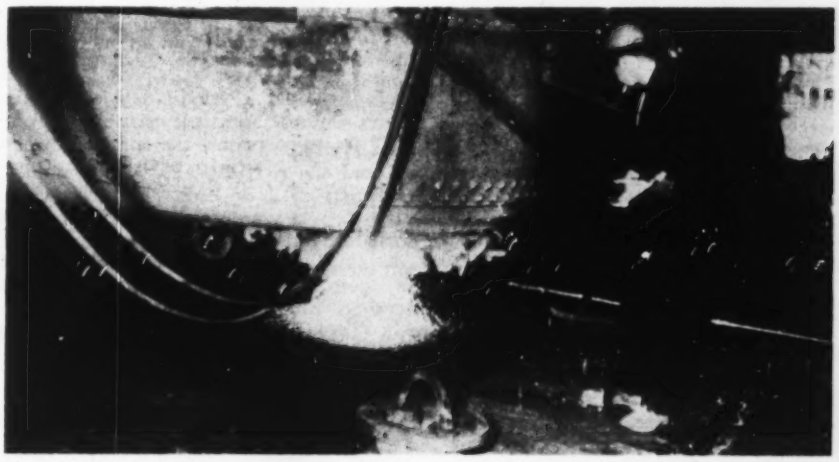

Fig. 2 The auto-pour for teeming ingots. A hydraulic cylinder operated by push-button remote control actuates the stopper.

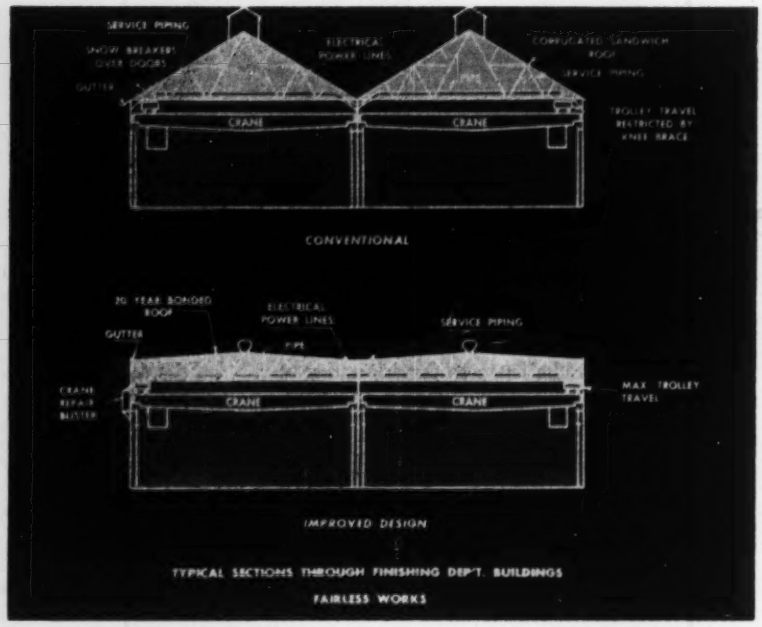

Fig. 3 Standard type of U. S. Steel mill building is shown at top. The lower diagram indicates how safety is promoted by improved building design at Fairless Works.

and refinement of safety methods are to be expected. We have ample knowledge of how to reach and maintain top safety performance. Our problem is primarily one of securing adequate application of the tried and proved methods.

Safety Manuals

U. S. Steel management feels there is a definite need for a safety guide or manual pertaining to physical conditions. It is true that there are federal, state, and local requirements, but these cannot cover all of the problems encountered in each and every plant. Safety manuals should be supplementary to government regulations for the design, installation, and maintenance of equipment, buildings, and facilities. Such a manual also should cover the application of safety devices and precautions necessary to protect the employees from dangers incident to machinery and working conditions.

To apply a guide in practice it is necessary that it be available for reference at any time by everyone involved in the problem.

Safety is so complicated and has so many ramifications that it is often difficult to cover every subject properly with one manual.

For example, U. S. Steel has an "Explosion Hazard Manual" as a reference for the proper design and construction of facilities in which there are inherent or potential explosion hazards. This manual also sets forth the fundamental principles of correct procedure for the safe operation of such facilities.

Sections of the explosion manual depend upon the plant facilities. Example headings of sections are "Boiler House" and "Gaseous Fuel Lines." Typical subdivisions are "Specifications" and "Procedures."

Specifications cover the general principles to be adopted in the design, materials of construction, and installation of equipment. Procedures outline the basic methods for safe operation of facilities.

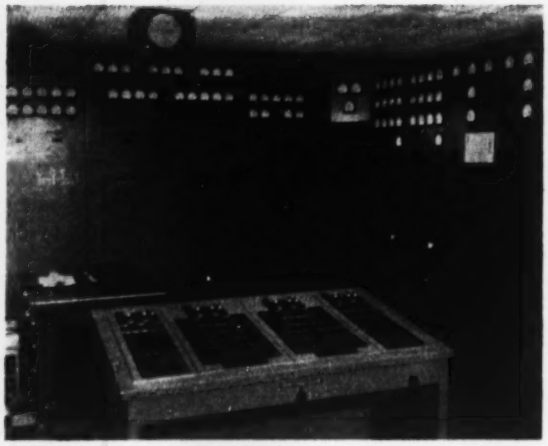

Fig. 4 In this control room attendants are fully informed of mill operations and perform all main switching from one point

Periodic revision of safety manuals is necessary to retain their usefulness. A loose-leaf binder is preferable to permit the addition of new and the removal of old material as revised from time to time.

Safety at Fairless Works

A good example of the application of the engineering approach to solve tough safety problems is shown in the construction of our new Fairless Works.

Many outstanding improvements have been provided at Fairless in building design. The upper part of Fig. 3 shows the standard type of mill building customarily erected in the past by U. S. Steel. Note the steeper-pitched roofs requiring snow breakers and gutters over doorways. In other areas not protected, icicles form on

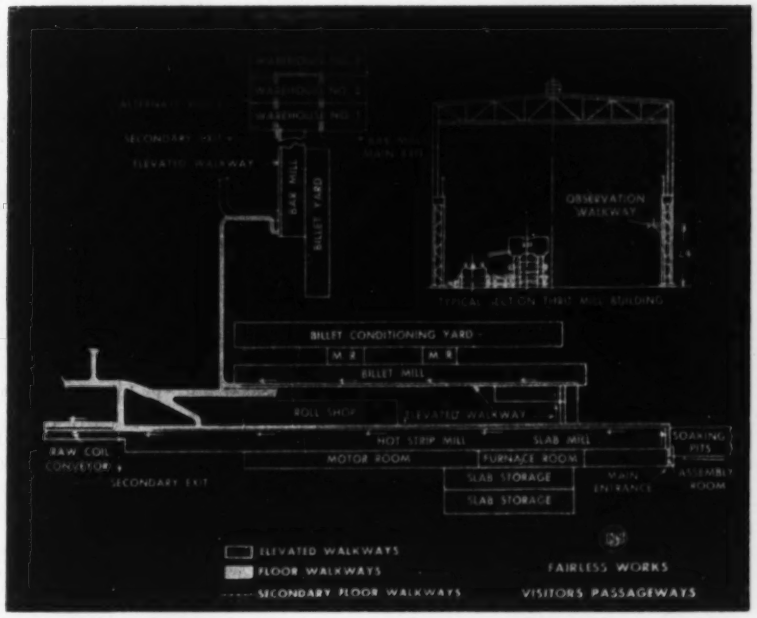

Fig. 5 Balconies and walkways are provided for observation to keep visitors away from dangerous areas

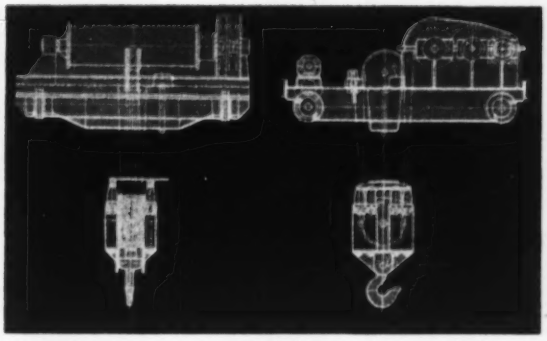

Fig. 6 Device for catching falling crane-hook blocks when limit switches fail or cables break

the eaves and snow slides occur frequently. It is difficult to keep such roofs from leaking and they must be painted or repaired frequently. Overhead piping and cables are installed toward the center of the roof truss, and when they cross from one bay to another, they must duck down under the eaves. The building knee braces also are hazardous.

The lower diagram shows that many of these faults have been corrected by the use of a different type of "so-called" flat roof. The roof has very little pitch. It has a steel deck with built-up bonded roof. Gutters are built in and no knee braces are required. Pipes and cables run both ways in the roof-truss area and are kept near the columns where drops can be made safely and easily. At the left a crane-repair blister is shown. The blisters are spaced at convenient locations to give crane repairmen safe places to work.

Another interesting feature of our modern buildings is the elimination of windows. By omitting windows, the expense and man exposure of window cleaning and repairs are eliminated. Of equal importance is the lighting safety factor. By providing artificial lighting throughout, the intensity is constant 24 hours of the day, thus eliminating glare and shadows characteristic of so many of the older steel-producing plants in the country.

All main switching at Fairless is centralized in the powerhouse by the use of supervisory control. Fig. 4 is a view in the control room.

Safety features are continually being developed and standardized throughout U. S. Steel plants. For example, a study of floor-grating spacing was made to determine the safest grating at minimum cost. Studies have also been made on stairways, ladders, and platforms.

In order to keep visitors out of dangerous areas, many balconies and walkways have been built for observation of the operations, such as the typical example shown in Fig. 5.

Falling crane-hook blocks have given us much concern when limit switches fail and cables break. Our engineers designed a device for catching the block. It was satisfactory with light hooks but we needed something of wider application. Consultation with various crane manufacturers led to a promising design as shown in Fig. 6. It works on the principle of absorbing the kinetic energy of the hoist mechanism with coil springs without exceeding the safe load on the hoisting cables.

Engineer the Key Man in Safety

The engineer is a key man in safety work. He must have the latest information on and be cognizant of modern safety practices properly to incorporate adequate safety devices in the design of modern production facilities. The team of management, including the engineers, the operators, and the workmen, must constantly strive for a better safety record.

Engineering Education in Russia

By M. H. Trytten

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Washington, D. C., and Consultant to the Engineering
Manpower Commission of Engineers Joint Council

In Russia, the role of technology and of technological education as the basis of economic and military power has never failed to be consciously understood. The Russian state has been in a position to implement this point of view from the top down. In contrast to our system where our motivation in the support of education has been the benefit of the individual, there it has been for the state and for the purposes of the state alone.

It has long been a copybook maxim that "knowledge is power." Perhaps we have always held that this is so. But it has remained for the recent years to demonstrate the crushing force of this truth. As mankind has gained more knowledge of nature and its secrets, the power at his disposal by manipulating the secrets of nature has increased by geometrical proportions. That power, like all power, we have learned, can be metamorphosed by simple means from one kind to another, from physical power to technological power, to economic power, and finally to political or military power, or both, as never before in the history of the world.

It was the United States that demonstrated dramatically the truth of this statement in World War II. Prior to 1941 the United States was the least military of all the great powers. Our military establishment was pitifully small in the years after demobilization immediately following World War I. In the year or two prior to Pearl Harbor, when we were again mobilizing, our ground forces were small, practically without equipment, and we had done very little to bring up to date what we had. We were, in fact, a peace-minded country caught with very little preparedness for war and yet faced with the greatest of all wars.

Technology the Secret of Power

In the ensuing six years this nation built and equipped the greatest military force in history and brought to bear a technological power which created and produced in quantity the most devastating military equipment ever known, by a large factor. All of this was done by the use of technology produced and developed for peacetime uses but readily adaptable to military needs. The secret weapon of this phenomenal performance was quite simply a corps of scientists, engineers, management experts, and other specialists whose knowledge was the nation's power in time of need. The nation triumphed because of its highly trained personnel.

It is, of course, not necessarily true that history will again repeat itself in the same way in any future emergency. But there seems little reason to suppose that in any power formula for the future the role and function of highly trained manpower will not again be of the highest importance. The strength of a nation is not measurable by corps, divisions, or battleships in any dominant sense. Its technological power is and will be of the greatest importance. And this is only to say that its corps of specialists, and its means of training more, will be as significant in measuring its power potential as any factor, and more important than almost any other factor.

Education a Local Responsibility

It is particularly appropriate that this subject be one of concern to a great professional society in this country, since we as a nation do not have a central national agency to create educational policy and to provide for its implementation. Education has been traditionally decentralized to a high degree. It is locally administered and is reponsive to local control and local attitudes. Thus it is of the greatest importance that local understanding of the plan of education in the national life and in the national interest be disseminated by groups who are in a position to appreciate it.

This local control of education may have been our greatest strength in the past. It may, however, become our great weakness in the future unless greater awareness of the importance of education is developed at the local level.

It may have been our greatest strength in the past because education in America has always been a response to a peculiar deep-seated desire on the part of the American people. Perhaps it was part of the reactions of the immigrants who came to a country limitless in resources and vibrant with high hopes of the future, to think in terms of better educational advantages for their young. Perhaps it was part of the concept of democracy that each individual should have the opportunity to better his station in life and realize his highest potentialities. At any rate, whether it was a private school dependent on free-will giving or tax-supported public institutions dependent on the will of the people through their representatives, our schools have fared well and have grown strong.

As a result, probably not consciously anticipated fully in the minds of most people, the nation itself has grown strong. The flow of young people through the professional schools has given to the nation a powerful

Contributed by ASME Education Committee and Engineering Manpower Commission of Engineers Joint Council and presented at the Fall Meeting, Milwaukee, Wis., September 8–10, 1954, of The American Society of Mechanical Engineers.

annual transfusion of trained minds who have found their places in our great industrial and other organizations to help create and develop the technological civilization we enjoy.

However, the boons of the past cannot be taken as guarantees of the future. If a locally controlled and locally responsive educational system is to serve national needs in a modern world, local attitudes and local considerations will not be enough. Much has happened to our educational system in the past few decades. The great increase in school enrollments and the consequent concern for the students who do not intend to go on to college has had its effects in focusing attention on the needs of terminal students. Local needs and local influences have been increasingly felt. There is grave concern that in so doing our schools have been increasingly neglectful of those who plan to go further into college and the professions. There is growing concern that fewer of our high-school graduates are prepared to go on to the rigorous curricula of the specialized branches. The national interest may have suffered. In a world where power is a matter of greater and greater moment to the United States, the power that resides in our technology and hence in our national resources of trained personnel must be a concern of all who are influential in shaping our educational effort.

The Russian Approach

It is considerations of this kind which make more significant an examination of the Russian effort in technological education. There, technological education as the basis for military and economical power is well understood and is controlled by the state for purposes of the state. In contrast, the American tradition is one of deep concern for education because of the opportunities it gives to the individual to realize his own best potentialities. The national needs for the products of the system have been less consciously motivating. Our highly trained personnel has come about almost as a by-product. In Russia the interest has been consciously national and has arisen from the realization that education and training are necessary to the growth of their power position of the state. The benefits to the individual have been by-products.

In prerevolutionary days educational opportunities in Russia were indeed limited by comparison with those in other Western countries or with the United States. Before the first world war the United States, with a population about one third smaller than that of Russia, had a secondary and elementary-school enrollment almost twice as large. American universities and colleges had four times as many students as did Russian schools. In 1914, in Russia only about 8 million children attended school, while probably as many as 30 million remained illiterate. In many Asiatic provinces of the Russian empire less than 3 per cent of the population was literate.

Immediately after the Revolution of 1917, an effort was made to correct this shortcoming, and educational opportunities expanded somewhat, although quite modestly. During the 1920's Soviet education was turned into chaos. Under the impact of ideological dogmatic preconceptions and under the influence of extreme ideas of Western liberal educators, Soviet education became highly experimental and an extremely permissive system. Learning by doing was carried to the point of the withering away of schools. The standards of scholarship deteriorated to an unbelievably low level. The expansion of secondary and elementary-school enrollment was at a virtual standstill. Training of the professional both in numerical and qualitative terms was at a point of stagnation.

Advances in Russian System

From about 1930 the emergence of an industrial order brought about a drastic change. As the theory of withering away of state, of law, of school began to be revised, we see the restoration of the traditional school, of traditional methods of teaching, with heavy stress on the teaching of mathematics, the natural sciences, physics, and chemistry. As complex technology began to emerge under rapid industrialization, as bureaucratic power structures began to emerge and consolidate power in their hands, the leaders began to stress the key role that education of the specialist must play in the development of the communist state. National power, economic power, the power of the state began to be associated with specialized professional know-how, with the regular cadre of specialists.

Great changes indeed have been made during the past 25 years. Elementary school has been made compulsory. It is now the Russian boast that seven-year schools are essentially universal, and they expect that by 1960 the ten-year school will be universal. Enrollment in regular higher-educational establishments training professionals of various types has grown sixfold. Training of supporting semiprofessional personnel increased more than sevenfold. All of this expansion, of course, took place under rational calculations to satisfy the needs of the state and its expanding economy and power. Frequent utterances bear out this fact.

The purpose of higher education is expressed in the Soviet encyclopedia as follows: "To prepare highly qualified politically trained engineering personnel with well-rounded education, cultured, whole-heartedly devoted to the motherland and to the course of Lenin-Stalin, capable of completely mastering and using the newest accomplishments of advanced science and technology and of merging scientific theory with the practical work of building a Communist society."

In a recent publication in Russia the remark is made that "The nature of the state determines the aims and purposes of Russian education," and quotes a remark by Stalin that "Education is an instrument whose effect depends on who wields it."

A remark by the eminent physicist, Peter Kapitza, is of particular interest. Speaking in 1943 to the Praesidium of the Russian Academy of Science, he said, in commenting on the central emphasis on science and technology in Soviet planning: "This is mainly conditioned by the special place allotted to science in our socialist country. Of course, it is well known and generally accepted in other countries, too, that science plays a great part in the development of culture and

technology. It has been allotted the leading part in the development of our technology and economic life. Therefore, the organization of science in our country must be more systematic and conscious of its aims than it is in capitalistic countries where it is rather left to chance and has a spontaneous character. In our country the bonds between science and life must be closer and deeper."

Soviet education as an instrument of the state is also strongly supported by the state. About 14 per cent of the annual budget is set aside for so-called cultural educational expenditures, and although the share of educational expenditures as such is uncertain, the high degree of support is undoubtedly evident.

The Educational System

The Soviet educational system begins with kindergarten into which children enter at three. How universal kindergarten now is cannot be determined, but it is believed to be fairly general, at least in the major urban and industrial centers. In these schools the elements of reading are taught so that the child should be able to read upon entering the elementary school.

The elementary schools are of seven years' duration and concentrate on the three R's with other types of activities in music, art, and so on, after hours. Homework is heavy, being specified as increasing from $1^1/_2$ hours per day in the second grade to $3^1/_2$ hours in the seventh grade. During the seven-year school a pupil spends about 6.5 thousand hours in class instruction, which lasts each year for 33 weeks with six days of required attendance each week. About 32 per cent of the seven-year curricula is devoted to arithmetic, algebra, geometry, the natural sciences, introductory physics, and the elements of chemistry.

After elementary school the student may enter secondary school or a technical school known as a technikum. In the secondary schools, open generally to the better students and largely preparatory for higher education, emphasis is strongly on science and mathematics for all students. There are no electives and about 40 per cent of the curriculum is devoted during the three years to these subjects for all students. These schools are, in general, large as a result of established policy so as to make it possible to have each subject taught by a competent teacher specializing in a particular field of study.

The secondary school is a matter of considerable concern in Russia. The Party Youth Organizations, the Comosomol, since the early 1930's, foster and encourage high scholarship among students. The leader in a Soviet class must usually be a good student—not necessarily a football hero. Indoctrination into the Soviet way of life, of course, permeates this, as well as other levels of education.

Enrollment

Perhaps some general statistics may give a concept of the increase in the Russian educational effort during the past two and a half decades. While in 1926 the enrollment in primary and secondary schools was about 10 million out of a population of 147 million, or about 7 per cent, in 1950 it was 33 million out of an estimated population of about 193 million, or about 17 per cent. It should be borne in mind that this includes a ten-year education, not twelve, as in America. In the United States, in 1950, the enrollment in the primary and secondary schools was 30,470,000 out of a population of about 152,000,000, or 20 per cent. Soviet upper-grade enrollment (Grades 8 to 10 of the ten-year school) during the past five years increased fourfold and in 1953-1954 was about 4.6 million, which is only about one third smaller than our four-year high-school enrollment. This increase has taken place while our own upper-grade enrollment has been experiencing the results of a low birthrate in the 1930's. Graduations this summer were about 760 thousand, as compared with virtually none in the middle 1930's. It should be remembered that these graduates were required to have rigorous preparation in the sciences, while perhaps only 20 per cent of our graduates had general science courses and only 6 to 8 per cent had any physics and chemistry.

In higher education in Russia the enrollment in 1951-1952 was 916,000, a 50 per cent increase over the enrollment of 620,000 in 1939-1940. In the United States the enrollment was 2,100,000, a 55 per cent increase over the enrollment of 1,364,000 in 1939. However, it must be borne in mind here that a large percentage of American college students are not in training as specialists but are in college for a general education without fixed vocational goals. This is especially true of women.

Those who do not enter the secondary school may enter the technical schools or technikums. These are three or four-year schools of a highly practical type intended to train technicians in a variety of subjects, including engineering, agriculture, medicine, law, and pedagogy. The products of these schools are what may be called semiprofessional and are an important factor in the Soviet economy. These trained semiprofessionals represent the core of the Soviet supporting and intermediate-level technical personnel, which in America we must supply through our technical institutes, junior colleges, and even through the regular four-year colleges as well. Their training, while short of professional training, is probably beyond that of technical institutes in the United States. The courses are about 40 per cent theoretical and in engineering include mathematics through the calculus.

In engineering alone these schools probably graduate over 50,000 technicians per year. Since a part of their training has been on the job in industry they are prepared to enter at once into the industrial labor force. While technikum students are trained directly for work at the technician level and do not have much prospect of aspiring to higher levels, the door is not closed entirely in that about 5 per cent are selected because of superior accomplishment and promise for further study at the universities. There were in Russia 3543 technikums in 1952 with enrollments of about 1,000,000 students. Graduates numbered about 350,000 per year. Of these about $^1/_7$ are engineering technicians indicating the figure of about 50,000 used in the foregoing.

University Level

Some idea of the level of work accomplishment expected of the secondary-school graduates as a basis for university entrance can be inferred from the entrance examinations. These include besides Russian language, literature, and history, up to three languages, mathematics, physics, and chemistry. The mathematics examination includes the usual algebra and geometry, but in

addition, some complex number theory, theory of equations, progressions, logarithms, and the binomial theorem (trigonometry is included); chemistry includes some organic chemistry.

Because of its origin and because of the practical goals of the government, higher education in Russia has had a very pragmatic development. There is little of the American notion of liberal-arts education, education for cultural values, or education to develop the capacity for valid value judgments. On the contrary, emphasis has been placed on the training of specialists even in the fields of linguistics, social sciences, or humanities. The emphasis on science and the practical arts has been heavy.

Higher-educational institutions in Russia fall into three classes. There are the traditional universities which to a large extent reflect the European pattern and are even yet strongly influenced by the heritage of Russian scholarship from prerevolution years. These are not many in number. They do, however, supply a large part of the flow of scientists who go into research in all types of laboratories and of the teachers in the secondary schools and universities, as well as in other types of schools.

Those of the second type are the specialized higher-educational establishments which were originated in the late 1920's and early 1930's by the ministries with technical responsibilities. They have since been placed under the aegis of the ministry of education but retain their special relationship to a particular area of technology represented by the ministry under which they were organized. It is in these institutions that the large majority of the engineers are trained. The curricula in these institutions are built around the industrial field of application rather than around the traditional subject-matter divisions. These are communications engineers, mining engineers, agricultural engineers, construction engineers, transportation engineers, and so on, rather than electrical, mechanical, or civil engineers, as in our system.

Engineering Training

Engineering training lasts five to five and a half years, and is based on about 5000 hours of lectures, classroom and laboratory instruction, attendance at which is mandatory. An engineering student spends about 65 per cent of his time on general sciences and general engineering subjects; about 28 per cent of his time is devoted to narrow specialization and only about 7 per cent to what are called socioeconomic studies, which are mostly political indoctrination subjects. The training is supplemented with periods of practical work in industry. This narrow specialization on top of some basic engineering training is responsible for the break-up of traditional divisions.

In 1939, in Russia there were about 750 higher-educational establishments which rose to about 900 in 1951-1952, a 20 per cent increase. This would not correspond to our 1700 institutions of higher education because of the large number of junior colleges and other types of institutions which would not figure largely in the training of specialists. Probably the number of American institutions in this field with four-year courses and substantial specialization along professional lines would not greatly differ from the 900—more or less.

In the matter of numbers of graduates, the history of the Russian effort indicates the changing emphasis on numbers and quality. While the number of graduates in all fields in the late 1920's was as many as 30,000 per year, the quality of instruction and the solidity of the training left much to be desired. Consequently, in 1930 and the following years, a drastic shakeup in higher educational institutions occurred which tightened standards and resulted in a temporary setback to the expansion of training. At the same time, however, there is evidence of much more attention to the selection of qualified faculties and effective instruction, as well as a rise in

In meeting the challenge imposed by advances in technological training in Russia, we are not required to abandon our principles of liberal and broad general education. However, we must improve the teaching of science at the high-school level; expand the training of scientists and engineers; and adopt a consistent policy for the preservation of professional manpower, especially engineering and scientific personnel. All of these are measures which are long overdue.

numbers graduating until by 1940 over 100,000 graduates, with almost 30,000 engineers, were emerging from training. The war greatly reduced the numbers in training and graduating, although this resulted more from the destruction of institutions by the German invasion than by policies of the government with regard to exemption of students. After the war there was an immediate national effort to rebuild the destroyed higher-educational establishments, particularly in the Ukraine. By 1947, 156 of the 162 higher-educational establishments in the Ukraine were again functioning. The remaining six were so completely demolished as to require complete replacement. In 1944 only 2200 students graduated from the higher-educational establishments of the Ukraine, but by 1946 this number had risen to 15,200, in all fields.

The number of graduates in the sciences is difficult to judge because of the differences in specialization and reporting. In engineering, however, the record is clearer. After the war the numbers of engineering graduates rapidly increased to about 29,000 from all Russian schools in 1948, to 30,000 or more in 1951, to probably about 40,000 in 1953, and to over 50,000 in 1954, according to late indications. This may be compared to about 19,000 from engineering curricula, unaccredited as well as accredited in American colleges and universities in 1954. It seems probable that the total number of trained engineers in Russia today is closely comparable to the number in the United States.

Russian Academy of Sciences

In the field of the sciences, advanced work is to a large extent done in the many establishments of the Russian Academy of Sciences which is a major factor in Russian science. There are two advanced levels of recognition neither of which is directly comparable with the American system of degrees. The first of these is that of "Aspirant" or "Kandidat" and is given after approxi-

(Continued on page 890)

Basic Conflicts in Engineering Education

By Arthur Bronwell[1]

Secretary of The American Society for Engineering Education

Engineers and engineering educators can usually agree on certain broad platitudes which express the desirable goals of engineering education. They also have little difficulty in agreeing on the shortcomings of engineering education. But it is in the means of achieving the desirable goals, where they find their violent discords. The author discusses some of the basic conflicts of viewpoint among engineers and engineering educators in the hope that this will sharpen the issues and thereby enable a better understanding of the problems involved.

Over the past quarter of a century there have been four broad movements in engineering education which have altered substantially our basic framework of engineering education. Looked at over the perspective of the years, these movements have been of revolutionary magnitude.

New Concepts of Engineering Education

First, there has been a substantial strengthening of the mathematics and basic sciences underlying engineering education. A quarter of a century ago, engineering education was based upon empirical knowledge and physical concepts which were often far too narrow to enable the engineer to understand the rapidly unfolding applications of science to engineering which were destined to come about in our time. It not only failed to give the engineer the essential underlying concepts with which to understand new developments as they came along; it actually retarded many of these developments because the engineer's knowledge was based upon inadequate, superficial, and often incorrect fundamental physical concepts. Consequently, there has been a very substantial shift, in an effort to build engineering education upon the firm foundations of basic science.

The second major movement in engineering education has been in response to the rapid development of new areas of technology having large-scale commercial applications. Such broad fields as chemical engineering, electronics, metallurgy, and aeronautical engineering not only have opened up vast new areas of commercial-engineering application, but what is of equal importance, they have revealed new frontiers of fundamental knowledge. Experience has shown repeatedly that these vigorous, youthful fields serve greatly to enrich and transform the traditional fields of engineering by the cross fertilization of new concepts and new methods of analysis.

The third major movement in engineering education has been the increased emphasis upon the development of what might be termed a balanced educational program. This has required a substantial strengthening of that portion of the curricula dealing with the humanities and the social sciences. These areas of education are today recognized as vital to the fullest development of the engineer. They give him that essential counterpart to his technical education which greatly improves his chances of attaining administrative positions and increases his competence in such pursuits. They enrich his life with an appreciation of the human, the aesthetic, the spiritual, and the moral values. They give him the basis of developing a sound philosophy of life and the beginnings of cultural interests which he can pursue later in life.

The three foregoing movements in engineering education have not been simple adjustments, readily achieved. They have evolved by slow trial-and-error processes, occasionally hastened by the clarion expressions of a few outstanding leaders who could clearly discern future trends. One of the dominant problems has been the time element. The demands of time made by the major shifts just outlined have necessitated a very substantial realignment of engineering curricula. This brought about the fourth major movement, which consisted of a substantial reduction in the amount of time devoted to the acquisition of particular skills and techniques, such as shopwork, drawing, the writing of laboratory reports, and so on. In the past, these have taken an inordinate amount of the student's time without providing the compensating advantages of intellectual development.

Conflicting Views

With this background, let us now review some of the major conflicts in viewpoints. We must concede that both science and technology are today moving ahead more rapidly than at any time in history. This is not merely the refinement of techniques which Spengler refers to as the "last gasp of a dying civilization." Rather, it is the penetration into whole new domains of fundamental knowledge which will continue to revolutionize our thinking of natural law. Some of these scientific frontiers hold great promise for engineering of the future.

For example, the ASEE Committee on Evaluation of Engineering Education in its Interim Report has urged that engineering educators take a careful look at the

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rapidly developing fields of solid-state physics and nuclear physics. Solid-state physics, which is still in its infancy, embodies the fundamental concepts underlying the properties of materials. It endeavors to provide the scientific explanation for the mechanical, electrical, magnetic, thermal, and metallurgical properties of materials. In the past, our knowledge of the properties of materials has been based largely upon empirical knowledge. A deeper and more fundamental understanding of these properties of materials inevitably will yield very substantial developments of new materials and their application. We are just beginning to realize the extent of the horizons which lie ahead in the development of new plastics, new alloys, new magnetic materials, and new dielectrics materials. But an adequate knowledge of these new developments must rest upon a solid scientific base, rather than on an empirical study of the properties as a function of the infinitude of variables in their composition.

Nuclear science embodies a new realm of physics, the potentialities of which we cannot fathom at this time. There are, of course, the obvious applications of the heat of nuclear fission and fusion for the generation of power. But quite apart from this application, it seems amply evident that here is a tremendously fundamental field of physics with great unknown potentialities awaiting exploitation. We have regarded it as essential for students to understand such concepts as heat, light, optics, and sound. Is it not reasonable that students also should have a knowledge of fundamental concepts of nuclear processes, including the transmutation of elements, the radiation phenomena associated with nuclear reactions, the fundamental processes involved in nuclear fission and fusion, and other significant aspects?

While we are considering new frontiers of knowledge which will be translated into significant engineering practice in the years ahead, we must not overlook the rapid strides being made in all branches of engineering. For example, combustion, vibration analysis, metallurgy, elasticity, electronics, theoretical mechanics, fluid mechanics are a few of the fields which are moving rapidly into new domains of knowledge and application.

The fundamental concepts in these newly developing fields never make themselves known in clear-cut delineated form. There is always a tedious struggle to determine what is essential, what are the fundamental concepts, how can these be organized into a clear, logical, and orderly sequence for teaching purposes. How can this material be integrated with other material in the engineering curricula so that the student gets some concept of the systematic orderliness of the physical sciences, rather than a scatter-shot treatment of many fields which have no relationship to each other?

Emphasis on Mathematics

There has been a growing emphasis upon mathematics in engineering education and this trend seems to be continuing. The reason for this is clearly evident. Mathematics not only has functional utility but in a larger sense it has a high degree of conceptual utility. Its functional utility is its use as a powerful tool of engineering analysis and engineering design. Its conceptual utility lies in the fact that it gives the engineer deeper insights into the physical processes at work. The value of this conceptual understanding should not be underestimated. It is the essential difference between the technician and the engineer. A student who has gained mastery of mathematical methods and their application has acquired a powerful conceptual tool which will give him great versatility in visualizing and utilizing scientific and technological knowledge. Mathematics also provides a means of unifying the underlying concepts in science and engineering. This unity is best exemplified in the application of differential equations to physical problems.

For example, there is a great deal of similarity both in conceptual understanding and in analytical methods among the generalizations of heat flow, mechanics of fluids, electromagnetic fields, and vibration theory. When a student understands these generalizations, he has gained a concept of the systematic orderliness of many fields of science and technology which will enable him to approach the solution of problems in widely diverse fields using the same analytical methods.

At about this point we meet head on with our first major conflict. It seems quite evident that, with engineering education bulging at the seams, new material cannot be injected into the engineering curricula without either some compensating deletions or an extension of time. Many practicing engineers and engineering educators hold that, although a deeper scientific base is desirable for all engineers and although a more comprehensive understanding of mathematical methods is very useful, still the blunt fact remains that a vast majority of engineers are engaged in the more conventional types of engineering practice, such as design, construction, manufacturing, sales, and other work not necessarily requiring a high degree of scientific skill or mathematical knowledge. This is the functional approach which lays primary stress upon the preparation of the engineer for conventional types of engineering practice. Those who hold this view resent the encroachment of more and more scientific and mathematical foundation material for what they regard as the highly essential concepts of design and engineering practice. They suggest that the engineering curricula are already overcrowded and that the deeper penetrations into fundamental concepts of science, technology, and mathematics should be deferred for graduate work.

Science Versus Practice of Engineering

The ASEE Committee on Evaluation of Engineering Education has emphasized that the primary emphasis throughout the engineering curricula should be devoted to the *science* of engineering rather than the *practice* of engineering. It believes that engineering courses, including design courses, should stress fundamental principles rather than descriptions of engineering practice as it exists today. There is considerable justification for this viewpoint. It is quite clear that a student who was taught the practice of engineering at any time during the past quarter of a century would today find that a great deal of his knowledge is obsolete. Furthermore, he also would have inadequate foundation for understanding and contributing to the new areas of engineering development which are based upon scientific applications.

Engineering practice is transitory; it is constantly developing new areas of operation and new methods. Furthermore, industry is much better equipped to teach the engineer the practice of engineering than is the

engineering college. It is believed, therefore, that a student who is firmly grounded in the fundamental concepts of science and engineering can later acquire the necessary knowledge of the practice of engineering in industry. If, on the other hand, the engineering colleges were to attempt to teach the practice of engineering, there would be no end to the vast proliferation of subject matter which would have to be included to cover the essential areas of engineering practice. This would greatly dilute and weaken the treatment of scientific and engineering fundamentals.

The Monolithic Concept of Education

But let us proceed to a consideration of other conflicts in viewpoint. There are engineering educators who hold that all of engineering education should be unified into a single monolithic undergraduate curriculum of either four or five years' duration. Presumably this universal curriculum would have a substantial scientific and mathematical base and in addition it would penetrate to a reasonable degree of depth in each of the principal branches of engineering, such as electrical engineering, mechanical engineering, civil engineering, and chemical engineering. This represents a somewhat broader engineering base than our present specialized engineering curricula offer. Those who would unify all engineering into one curriculum claim that the present division of material into civil, mechanical, electrical, and chemical engineering is wholly artificial. They claim that in practice the engineer is called upon to solve problems in many diverse fields rather than in a single field. The present curricular breakdown, therefore, is not realistic in terms of what the engineer is required to know and do.

The opponents of the monolithic curriculum point out that the present structure of curricula specializations provides a high degree of flexibility for growth of the new and important splinter groups. They assert that if engineering education had developed as a single monolithic curriculum in the past, such vital subjects as electronics, chemical engineering, metallurgy, and many others, which in the earlier days were the barbaric renegades, might never have gotten started as major curricula areas or options. These vital and rapidly developing fields of engineering were forced into the curriculum against severe opposition from the more orthodox professors who saw no need for change. How much greater would the opposition have been if engineering education had developed as a single monolithic curriculum? In unification, there is grave danger of producing unwarranted rigidity and freezing of subject matter. This inhibits the growth of new ideas and new domains of knowledge. The flexibility provided by a moderate degree of specialization in the various engineering curricula has provided open-ended opportunities to try out new concepts, new ideas. Some of these have been inconsequential and have fallen by the wayside; others have become essential parts of engineering education.

One of the potentialities of improving engineering education, which is widely discussed but in which little progress is made, is the possibility of bringing about a greater unity in mathematical methods as applied to various fields of science and engineering. This attempt at unification takes several different forms. In one plan the unification would spring from certain fundamental properties which are common to all fields of engineering. For example, power and energy seem to be common throughout all of engineering. It would seem logical therefore to start engineering analysis with the fundamental concepts of power and energy. Such universal principles as the conservation of energy, the equivalence of electrical, mechanical, and chemical energy, etc., would be the starting point from which all mathematical formulations would be developed. This road, however, is fraught with insurmountable obstacles, for it is not always easy to develop mathematical formulations from power and energy concepts; in fact, in most cases it is very much easier to start with the force concepts and develop the power and energy relationships from these. Furthermore, in many types of dynamic problems, the principle of conservation of energy cannot be applied satisfactorily. In these cases it is often virtually impossible to derive fundamental relationships starting with the power and energy relationships. Therefore I think that we will have to regard this approach as just another Utopian blind alley.

Another attempt at achieving a greater degree of unity is that of developing the similarities in mathematical methods as applied to various fields of engineering, such as heat flow, electric and magnetic fields, vibration theory, fluid flow, and the like. This can be achieved at a moderate level of mathematics by dealing with one-dimensional problems. It can be achieved much more satisfactorily and much more generally by using the three-dimensional mathematics of vector analysis, but this requires a more thorough grasp of mathematical concepts. The latter approach helps the students to see unifying themes and connectivity. Instead of forever struggling up the mountainsides in innumerable specialized one, two, or three-dimensional problems, the student is led rather quickly to the mountain tops where he can survey the surrounding terrain from a high vantage point; there he can see the broader generalizations and the unity in analytical methods throughout much of science and engineering.

Here again we meet sharply opposing viewpoints. Those who oppose this unified approach claim that the students learn best by proceeding from specific cases to the general rather than from the general case to the specific. They contend that the students become confused if they are confronted by complicated methods of analysis and strange physical concepts from many different fields simultaneously. They would prefer to have each field of application developed from its own concepts along orderly, logical lines of approach which proceed from specific cases to broader generalizations.

Duplication of Subject Material

It is frequently suggested that time might be saved by eliminating the duplication of material. For example, it is pointed out that sophomore physics deals in a shallow manner with the subjects of statics and dynamics. Later these subjects are taken up much more thoroughly in specific engineering courses. Would it not be possible to consolidate this material into one course and eliminate the duplication? Here again we hear many platitudes but find little experimentation.

It would be interesting to have several schools experiment with means of achieving better utilization of time by minimizing duplication and going into a subject thoroughly the first time that the student is exposed

to it. On the other hand, it has been pointed out that acquiring an education is like moving along an expanding and rising spiral. The student sees the subject matter over and over again in new and enlarged applications and this process of repetition is a vital part of acquiring mastery of the subject. Just how essential this repetition of subject matter is to a proper understanding has never been determined. Certainly there is a great deal of repetition throughout all of our engineering curricula. Perhaps a little carefully planned experimentation might be helpful in this direction.

Social Sciences and Humanities

I have mentioned previously the need of developing an adequate program of courses in the social sciences and humanities in order to give the student cultural balance and functional knowledge in these fields. Here we run into a sharp collision of viewpoints. There are those who believe that this portion of the educational program should deal primarily with courses of a *functional* nature, designed to give the student that knowledge which will benefit him most in professional practice and administrative positions. It should acquaint him with the principles of organization and management, human relations, corporation finance, government, accounting, human psychology, and economics approached from a utilitarian viewpoint. These proponents point out that the majority of engineers become involved either in supervisory or managerial work. This area of education should give the student a grasp of fundamentals which will enable him to make intelligent decisions in these areas of responsibility.

On the other hand, there are those who believe that a substantial portion of this part of the curricula should be directed toward an appreciation of literature and the arts; an understanding of the major philosophies which have guided the course of civilization; psychology and philosophy approached from a broad cultural viewpoint rather than a strictly applied viewpoint; an understanding of the theory and functioning of our economic system; and the evolution of our industrial, social, and political institutions, with emphasis upon the growth of ideas which led to their present development. They believe that this portion of the curriculum should instill moral and spiritual concepts into the student's thinking and give him the foundation upon which he can develop a sound and meaningful philosophy of life.

These divergent viewpoints are quite irreconcilable. The amount of time devoted to this area of instruction in engineering curricula is usually about 20 to 25 per cent of the total time. It is quite impossible to do a thorough job of satisfying both objectives in the amount of time available. At this point we must humbly acknowledge the bemoaning of the employers who condemn engineering education because it fails to teach students how to write reports, how to use good English, and how to become more articulate.

In the matter of duration of the engineering program, we meet another sharp divergence of viewpoint. Most engineering colleges today operate on the equivalent of a 4-year undergraduate program. A few have shifted into a 5-year program. The proponents of the 5-year curricula visualize the engineer as a highly educated professional man, with considerably better preparation in the fundamental sciences, the engineering specializations, and the cultural studies, than is possible in a 4-year program. It is their contention that the technical institutes will supply more and more of the everyday run of engineering talent. The engineer of the future therefore must be called upon to work in the newer domains of engineering practice, requiring a high degree of scientific and technical knowledge. With this kind of educational preparation, the engineering profession can make its highest contributions to the advancement of the art of engineering.

Those who hold to the 4-year program point out that education is already eating up life. They point out that most engineers require a period of apprenticeship before they can make significant contributions. It is essential therefore that the education program should not be prolonged beyond that necessary for an adequate foundation. They also point to the fact that those engineering students who want to pursue more advanced studies can do so by taking graduate studies.

Acquisition and Mastery of Knowledge

There are several other strategic problems having a vital bearing upon the quality of education which I should like to discuss briefly. The first of these is the need for recognizing the difference between the *acquisition* of knowledge and the *mastery* of knowledge. The fundamental concepts embodied in almost any course can be taught with a reasonable degree of comprehension in a relatively few class sessions. But this does not mean that the student has mastered that knowledge. Mastery of knowledge means competence in applying fundamental principles and analytical thinking to the solution of problems which challenge the student's intellectual resources. It is best developed by having the student come to grips with new and novel situations demanding exercise of considerable ingenuity and discriminating judgment. The development of this intellectual process is the very essence of education. Without it education becomes shallow and inconsequential. A student who acquires genuine intellectual habits in college, regardless of what his specialization might be, has gained a mastery of reasoning processes which will be valuable to him throughout his life's work. Intellectual development, i.e., the development of reasoning processes, not the mere acquisition of knowledge, is the true mark of an educated man.

There is always a danger that as more and more material is added, engineering education will become shallow and superficial. When this occurs the student does not acquire that vital experience of penetrating into the inner reaches of the subject and meeting head on with problems which challenge his intellectual resourcefulness. The ability of the engineer to appraise new problems and situations, to break them down into their essential components, and to proceed in an orderly and logical manner, to collect, assess, and analyze information, and to translate the conclusions into useful practice will, more than anything else, determine his competence as an engineer. It is essential that we recognize this type of intellectual growth, which we call the *engineering method*, as a primary objective of engineering education.

There is another problem which is currently receiving much attention in engineering education. This is the problem of how we can lead students to think creatively. It is quite clear that the intellectual processes involved in

analytical thought are not necessarily the same as those involved in creative thought. Were it not so, college professors would be the most creative people in the world, for in their work, they are required to develop a high degree of precise analytical thought. But it seems clearly evident that a person who has developed a highly analytical mind is often not very creative, and vice versa.

The creative process involves problems of motivation, imagination, fluency of ideas, and ability to associate new ideas. These are mental processes of which we know very little. They are traits which perhaps we do not strengthen in our conventional type of education—in fact, educators have often been accused of stifling creative talent. Just what can be done to develop these traits in college is not understood clearly. It is a subject which deserves thoughtful consideration and careful experimentation.

We must recognize that there are far more than techniques involved in genuine creative thinking. It involves a deep and abiding love of the subject, an irresistible spirit of inquiry, a highly motivated challenge. These elements are not likely to be present in any shallow course dealing with techniques of creative thinking.

There are many problems associated with the education of gifted students which educators are seriously considering today. Is it necessary for gifted students to be strait-jacketed to the conventional engineering program, progressing at a pace of intellectual development which is far below their latent abilities? Or is it possible to develop special educational programs which would make it possible for gifted students to progress at a pace commensurate with their talents and interests? Is this kind of intellectual development likely to inhibit the social development of the student? These are problems in which there has been a fair amount of experimentation although the results are quite inconclusive.

Developing Leadership Qualities

There is one other aspect to engineering education which has been the subject of widespread discussion. This is the problem of developing the latent leadership ability of students. Here is another problem which we know very little about. Studies have been undertaken to correlate leadership characteristics with various factors in their educational program. It seems evident from these studies that extracurricula activities have a vital role in helping the student to acquire those essential personal characteristics which will enhance his leadership abilities. One college president stated this quite succinctly when he declared, "I learned more about leadership with my two fists on the baseball field than in all of my education put together." Just how far we can go in developing the individual's natural aptitudes for leadership by formal education is not well known. For example, do the graduates of a course in business administration stand a better chance of reaching top managerial positions than engineering graduates?

Are we asking our students to focus too much of their thought upon the microscopic viewpoint of science, to the exclusion of the macroscopic viewpoint which is necessary for successful management? Are we educating engineers to be the deeply penetrating analytical minds so that they can become the hirelings of people of broader visions and larger perspectives? Or is it true that the training in the precise analytical thinking which the engineering student receives is actually one of the best forms of academic preparation for managerial and executive positions? Are we educating our share of entrepreneurs who will strike out boldly to form new enterprises and advance our industrial economy? These are problems which cannot be glossed over lightly. They are vital problems from the viewpoint of the advancement of the engineering profession and also the contributions which engineers can make to the advancement of civilization.

To resolve all of the foregoing conflicts is but to greatly oversimplify the problem. All of these viewpoints have very legitimate claims on engineering education. They clearly point to the need for preserving flexibility in engineering education and undertaking soundly conceived experiments. There is no universal formula for engineering education and an attempt to find such a panacea for all of engineering education is doomed to disaster.

Engineering Education in Russia

(*Continued from page 885*)

mately three years of study and research. While this level of accomplishment may approximate the doctorate in some fields, in others it may be more nearly the level of the master's degree. It seems probable, however, that, in general, and especially in applied sciences and engineering, it should be rated well above the master's degree if not in all cases equivalent to a doctorate. In 1952 there were about 5500 Kandidat degrees granted, not substantially different from our own rate of production of doctorates.

The second level of recognition is the degree of doctor of sciences. This degree is granted only after many years of research and substantial recognition by scientific colleagues. In 1951 there were about 531 such degrees granted.

In summary, it seems possible to conclude that the whole effort in science and technology is a serious one, with full support by the government, which is realistically conscious of the vital role of science and technology in the furtherance of Russian aspirations, be they economic, military, or political. There is evidence of substantial accomplishment, to the degree that Russian technology must be taken very seriously.

One further item may be mentioned. Prior to the recent war, military service was obligatory and the duration of individual responsibility was two years. Up to the end of the Stalingrad episode in 1943 students were called into military service. However, in 1943 a law was passed which had the effect of returning many to the universities and retaining students in their courses of training. According to this law, students in about 80 schools of technology were exempted from military service until graduation. Thereafter they were assigned for a period to specified posts in their specialties. As far as can be determined, this law is still in operation.

Thus Russia has apparently solved the vexing problem of the role of the technical specialist in a very direct manner, and in line with its realistic policy of considering scientific and technical personnel as merely another factor, but a most important one, in the total national military potential.

Pressing Parts From Powdered Metals

A new concept

By Byron B. Belden

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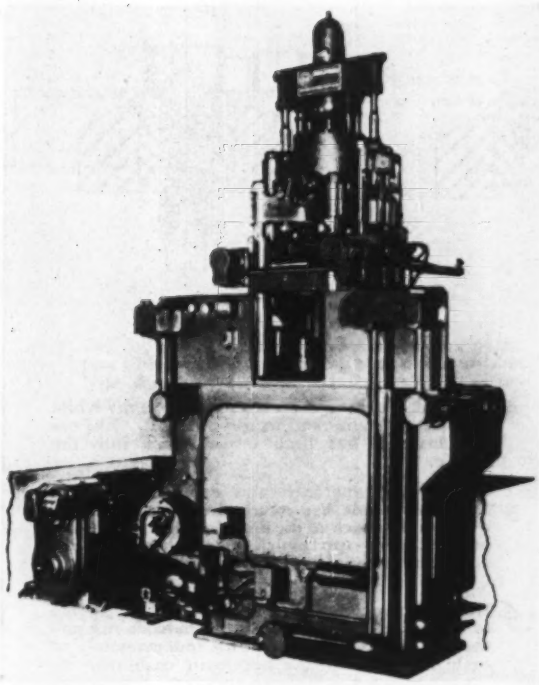
Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

- *Thin-wall bushings*
- *Compacting flanged part*
- *Pressing flanged part*



Typical mechanical four-column crank-type press

In recent years great strides have been made in the powdered-metal industry by equipment and materials manufacturers alike. Improvements in production methods have kept costs to a minimum.

Outstanding in the developments of the industry is the advance in press design which permits the use of simpler die sets without sacrificing the actions required. The presses are of the mechanical, four-column, crank type with two guide bushings for each column, which provide great rigidity with resulting accuracy in guiding the head upon which the top punch is mounted. Typical operations of the press are shown in these pages.

The head mounted on the four columns is actually a hydraulic cylinder in which a piston is in direct contact with the upper ram or top punch support. An adjusting mechanism allows the relative position of the top punch to the stroke of the head to be adjusted. Oil is contained in the cylinder above the piston, while mounted on top of the head and piped directly to the head is an accumulator. A hand pump is provided for getting the oil into the head. Pressure in the head is obtained by charging the accumulator with air or nitrogen.

Contributed by the Metals Processing Division and presented at the Semi-Annual Meeting, Pittsburgh, Pa., June 20-24, 1954, of The American Society of Mechanical Engineers.

The use of the hydraulic or floating head makes it possible to predetermine what pressure will be applied. In fact, beyond the slight compression of air or gas in the accumulator, the pressure cannot exceed the pressure with which the accumulator is charged. Also, a slight dwell of pressure is obtained by means of adjusting the top punch so that a floating action takes place during the pressing part of the cycle.

This design combines the advantages of both mechanical and hydraulic presses; that is, the speed or strokes per minute of a mechanical press are obtained while the pressure applied by the top punch is hydraulic.

A shuttle-type feeder is used with the hopper remaining stationary. The shuttle moves from a position directly under the hopper to a position over the die. The same volume or head of material is carried over the die each time, and the die is covered while the bottom punch is in the "up" or "ejection" position.

The fact that the die is covered before the bottom punch is retracted minimizes the problem of entrapped air in the die and sets up a condition whereby the powder is sucked into the die by the bottom punch.

The die holder is an alloy-steel casting rigidly guided, as previously described for guiding the head, by the same members guiding the ejector or bottom punch support.

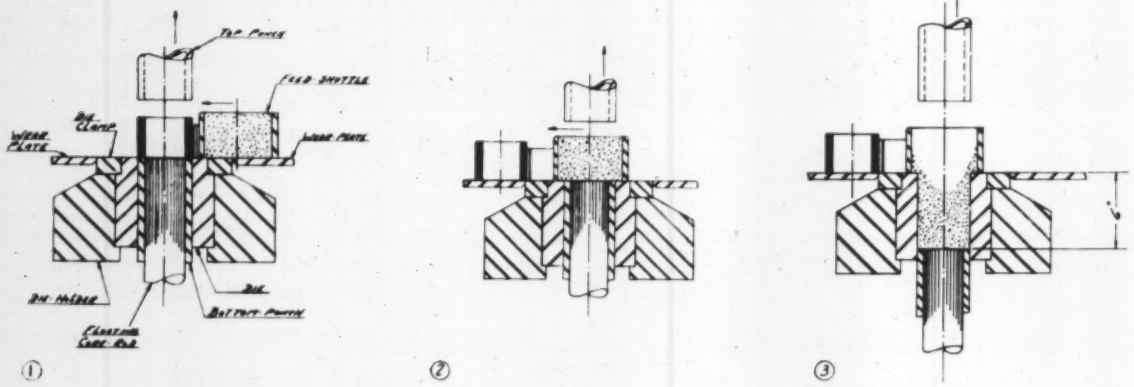
This die holder is held in its top position by two air cylinders with a regulator for adjusting air pressure.

Adjustable positive stops are provided to limit the travel or float of the die when pressing flanged parts.

Mountings are provided so that two core rods may be mounted in the press simultaneously. One of these mountings is stationary, while the other is movable; that is, it is held in its top position by a pneumatic cushion. Two adjustments are provided for this mov-

(*Text continued on page 896*)

Pressing a Thin-Wall Bushing



1 The part has been ejected from die. The illustration shows a top punch, a die mounted in the floating die holder, bottom punch, and a floating core rod. The die clamp which holds the die in the floating die holder is flush with stationary wear plates. The feeder shuttle is moving forward and will push the finished part from the die onto the stationary wear plate, as seen in 2.

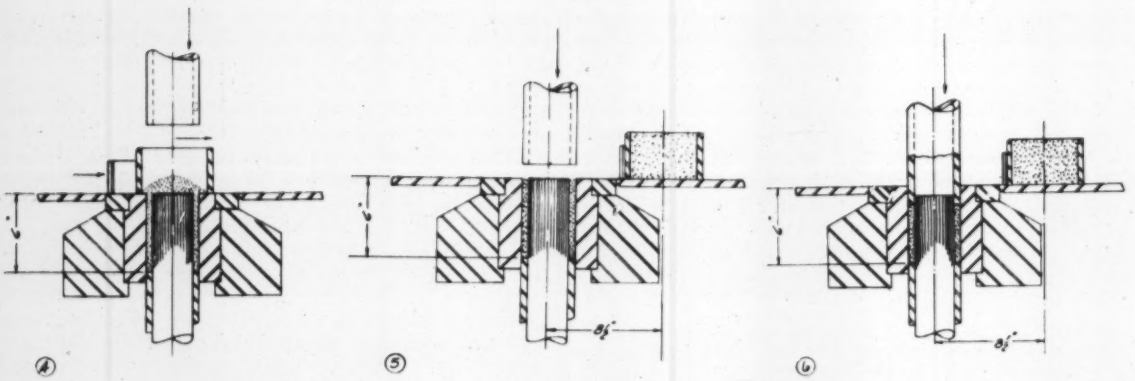
2 Note that the bottom punch and core rod are still flush with the top of the die while the feed shuttle has the die covered.

3 Both the bottom punch and core rod have been retracted. This allows the material to be drawn down into the die. The fact that the core rod has been retracted eliminates the filling problem that would exist had the core rod remained in the up position. The fill position of the bottom punch can be adjusted from a zero position to a maximum depth of fill. There is a separate adjustment provided for the stroke of the bottom punch, so that when it is in the ejection position it can be brought flush or slightly above the die surface.

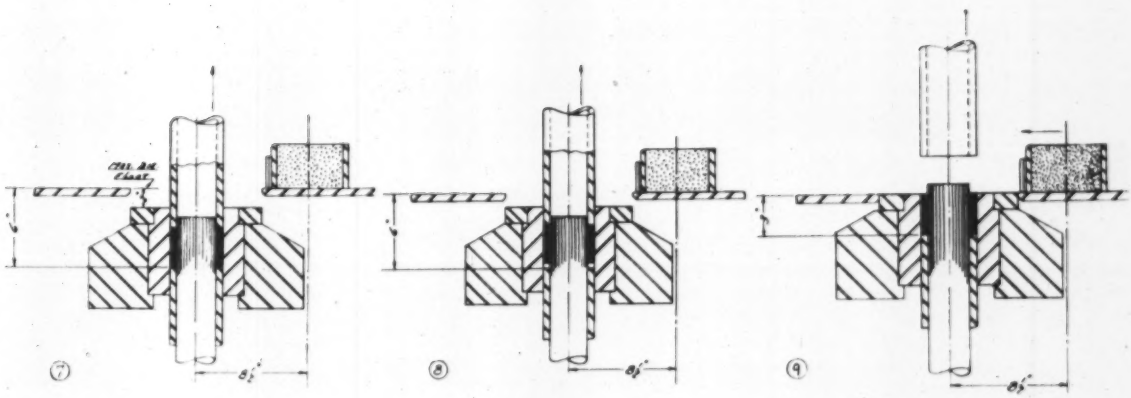
4 The feed shuttle remains over the die cavity while the core rod returns to its top position. The excess material has been pushed back into the shuttle.

5 The feed shuttle has returned onto a stationary wear plate in back of the die, leaving the die full of powder. The top punch has started to come down and is about to enter the die.

6 Here the top punch enters the die and has started to compact the material. Both the core rod and the die are free to float down independently of each other against the pneumatic cushions. As the top punch moves down and starts compacting the material, friction is built up around the core rod and inside the die. The core rod has moved down slightly while the die has remained up. This may not be the exact case and is shown to emphasize the fact that the core rod and die can move independently of each other. If it is desirable to obtain a differential movement of the core rod and die, it may be done by adjusting the air pressure in the cushion cylinders.



Pressing a Thin-Wall Bushing



7 The top punch has completed the pressing of the part and is ready to start going back out of the die. Note that the die has moved down as well as the core rod. In making a part such as illustrated, it is not necessary to restrict the distance which either the core rod or die can move.

8 The top punch is moving up; and the part as well as the die and core rod will follow the top punch.

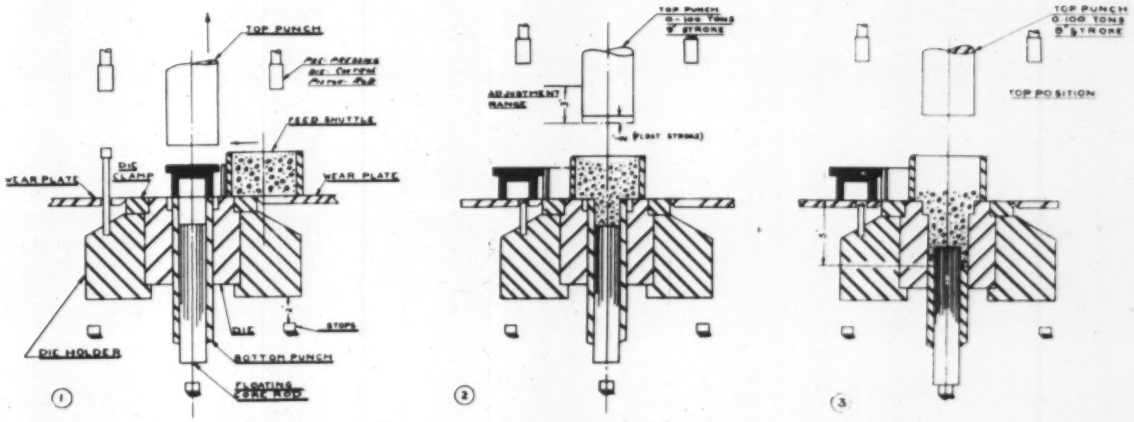
9 The top punch has cleared the die. The bottom punch has started to move and will push out of the die. Note that the core rod is going with the part and is actually protruding above the die surface. Provision is made so that the core rod may continue to move with the part until such time as the part has cleared the die. A slight expansion will take place within the part itself and the core rod will be retracted to a position flush with the top of the die surface before the feed shuttle moves to push the part off from the die as in operation 1.

Compacting a Flanged Part

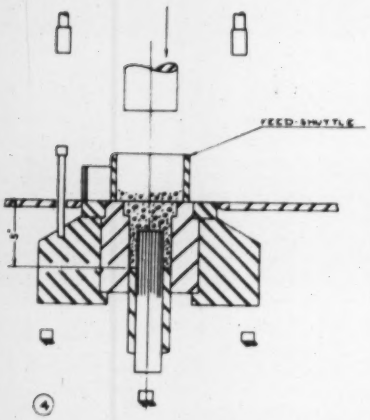
1 The parts of the die involved for compacting a flanged part with a counterbored hole are the same as shown in the first series of operations. The difference is that the die itself has a counterbore in the top to form the flanged section of the part. The core rod is down a predetermined distance from the top of the die, to allow for the fill of the section above the counterbored hole. The top position of this core rod is adjustable. The small blocks shown below the die holder and floating core rod represent the stops. These stops are adjustable and have indicators so that they may be set to within 0.001 in.

2 The part has been pushed onto the stationary wear plate by the feeder shuttle with the bottom punch remaining in the up position.

3 Note that the core rod has been retracted against the stop. This has reduced the depth of the thin section and aids in filling the die.



Compacting a Flanged Part



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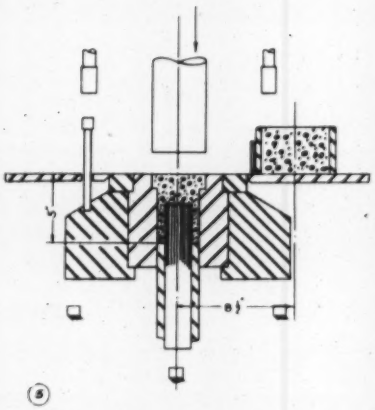

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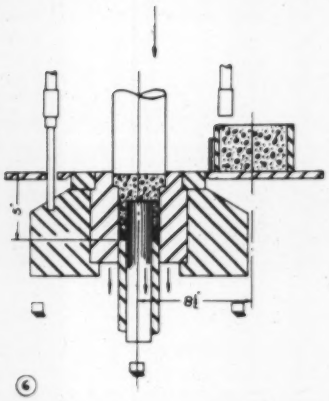

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4 This sketch shows the core rod returned to the fill position, pushing any excess material back into the feed shuttle.

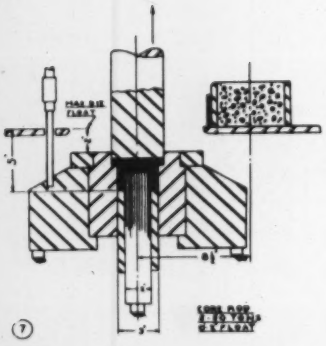
5 The feeder has returned to the stationary wear plate and the top punch has started down.

6 The top punch has entered and closed the die. At this point is introduced what is called prepressing die control. Two cushion cylinders are mounted on the side of the head of the press. The piston rods of these cylinders extend downward; the lengths of the piston rods are adjustable. The two members shown in this schematic drawing represent the ends of these piston rods. Note that the one at the front is shown contacting an extension of the die holder. In the actual press, these extensions of the die holder are to the right and left of the die, while the feeder is to the rear of the die. As the top punch moves down, the cushion cylinders force the die to move down initially at the same rate of speed that the top punch is moving. The core rod is free to float against its pneumatic cushion. The top punch will not enter the die any further. Since the bottom punch is stationary, the pressing is started in the bottom section of the part and continues up through the part. As the pressing is taking place the resistance to movement of the die gradually increases, and the top punch starts to enter the die further. As the top punch moves down, the cushion cylinders force the die to move down initially at the same rate of speed that the top punch is moving. The core rod is free to float against its pneumatic cushion. The top punch will not enter the die any further. Since the bottom punch is stationary, the pressing is started in the bottom section of the part and continues up through the part. As the pressing is taking place the resistance to movement of the die gradually increases, and the top punch starts to enter the die further.

7 The die has been pushed down against the adjustable stops and the top punch has completed the pressing of the part. The fact that the pressing was started from the bottom of the part and completed from the top with a moving die and moving core rod assures uniform density under the flange.

8 The top punch is moving up as well as the die and core rod.

9 This view shows the bottom punch pushing the part out of the die.



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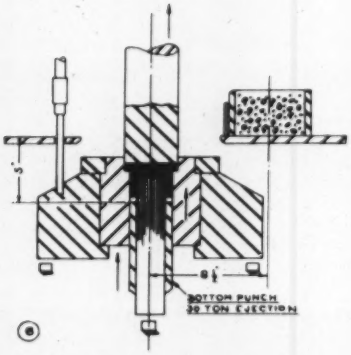

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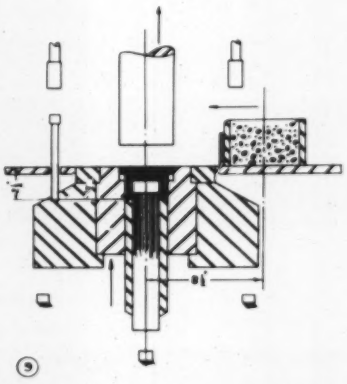

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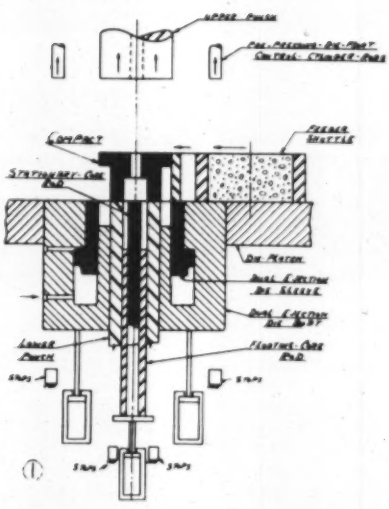
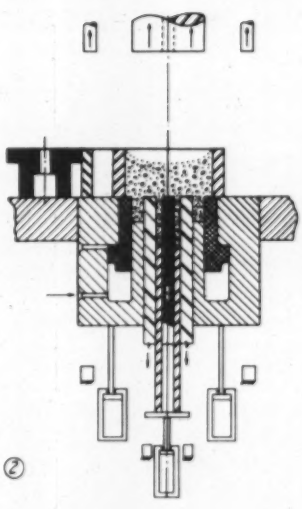
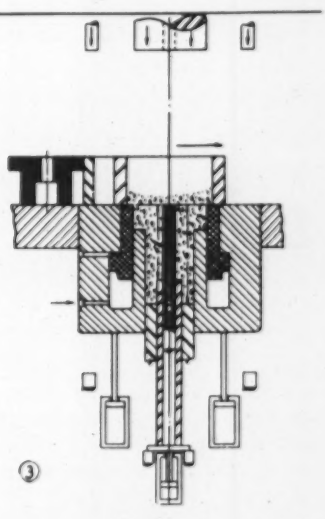
Pressing a Flanged Part







1 This series shows a typical cycle for pressing a flanged part that has a counterbored hole as well as a through hole and illustrates a dual ejection feature. In this schematic view, we see the part after it has been ejected from the die. Several additional components of the die are shown. Note that directly in the center there is a stationary core rod. This core rod at all times remains in this position. It is surrounded by a floating core rod, the lower punch, a die, and a dual-ejection die sleeve.

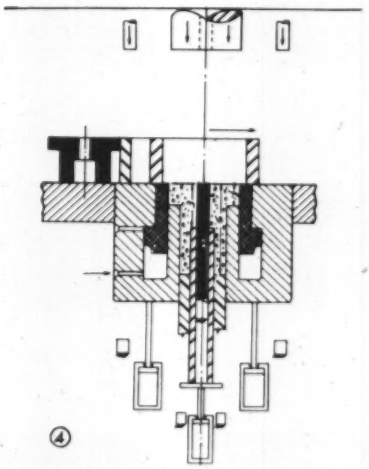
2 This sketch shows the shuttle covering the die with the top punch in the up position.

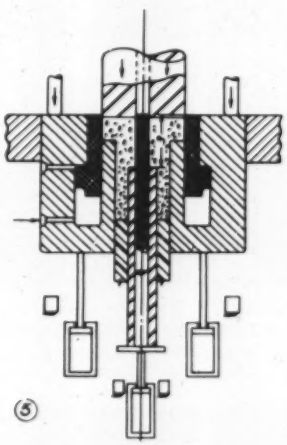
3 Sketch showing the bottom punch and the floating core rod both retracted.

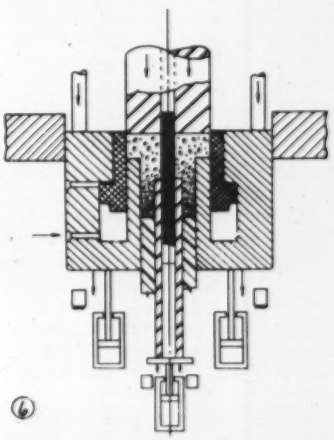
4 The floating core rod returns to the fill position before the feed shuttle goes back.

5 The top punch is just entering and closing the die. The prepressing operation is shown to advantage. Although metal powders do not flow under pressure, experiments have proved that it is possible to displace powder in the die before the actual compacting takes place.

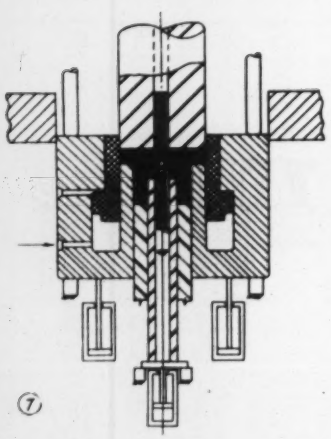
6 The die and top punch have both moved down together. Note that the top punch has not entered the die any further than shown in the previous slide. The shaded area in the bottom section of the part represents what is taking place in the die; that is, the pressing is being started in the bottom section of the part. Actually, powder would be crowded toward the top of the die.







Pressing a Flanged Part



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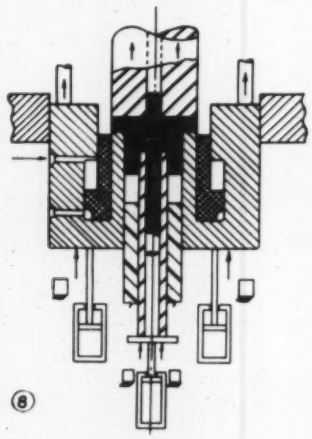

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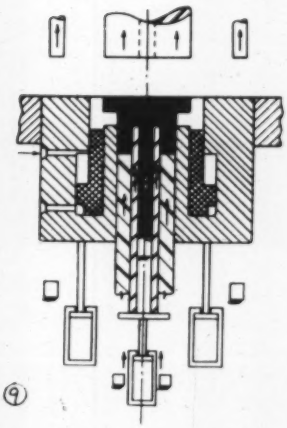

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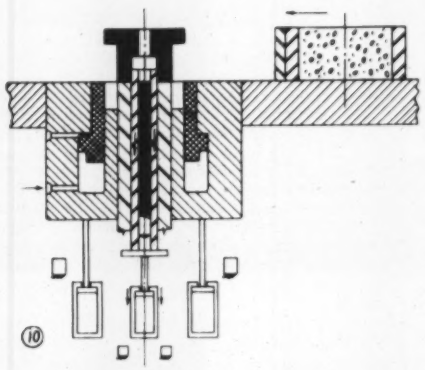
7 The core rod and die holder are shown against the adjustable stops while the top punch has entered the die to complete the pressing.

8 Here the dual-ejection sleeve is retracted. This takes place after the pressing has been completed and the top punch has started to go back up, but before the bottom punch starts to move. The part is still in contact with the top punch. Air pressure in the die-float cushion cylinders holds the part in this position. This tends to hold the flanged section of the part straight, particularly where there is a great difference in diameters.

9 The bottom punch is pushing the part out of the die, the core rod moving with the part. Since the die sleeve was retracted before the part started to move, there is no tendency to break off the flange from the part.

10 The part is shown flush with the top of the die. The core rod went out with the part and will be retracted before the feed shuttle pushes the part onto the stationary wear plate.



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ing or floating core rod, one for the top or fill position and one for the bottom or pressing position. The pressure in the air cylinders also may be adjusted.

The bottom punch or ejector in these presses is actuated by cams. The mechanism is so designed that there is no lost motion between the cams and the bottom punch. There are no cams to change. Simple adjustments make it possible to change the depth of fill and the ejection stroke. Direct-reading indicators indicate in increments of 0.001 in. the position of the bottom punch. The top punch also has an indicator so there is no guesswork as to its position.

All moving lubricated parts of these presses are completely enclosed and sealed to prevent any abrasive material from getting into the bearings. A gear-type pump driven by an electric motor forces filtered oil through a drilled crankshaft to the crank and connecting-rod bearings. In fact, all bearings subject to load are pressure-lubricated. A pressure switch insures that the press cannot be operated unless there is oil pressure in the lubricating system.

A control panel is furnished with the presses, so that they may be cycled as follows:

1 Continuous run.

2 Semicontinuous run with dwell; that is, stop at any predetermined point, and start automatically. Dwell time is adjustable.

3 Single stroke, that is, stop at any predetermined point, restart only when operator pushes "start" button.

4 A combination of steps 2 and 3, that is, single stroke and dwell in the same cycle.

5 Inching.

It has been customary throughout the powdered-metal industry to determine the pressure required to compact a part in terms of the number of square inches of cross section without regard to the length of the part. It has been found in tests that have been run that it is not enough merely to consider the number of square inches involved. The depth of fill has a definite bearing on the amount of pressure required to compact a part.

In some cases, pressing or compacting takes place during the ejection part of the cycle. In the author's opinion, this is the most common cause of length variation, even when the weight of the part holds constant. Allowing the die to float down along with the core rod provides for better density within the part. Allowing the core rod to float up with the part during ejection reduces the ejection pressure and aids in controlling length tolerances.

ASA Code for Pressure Piping

By Frank S. G. Williams

Manager of Engineering Standards, Taylor Forge and Pipe Works, New York, N. Y. Member ASME

For a general understanding of the American Standards Association (ASA) and the relation to it of the ASME and the Petroleum Industry, the author outlines the history of ASA and its present principles and functions. The organization of ASA Sectional Committee B31 and its operational methods are explained.

THE American Standard Code for Pressure Piping (ASA B31.1) is a safety code, and the following is a quotation from the introduction to the 1951 edition:

"The Code for Pressure Piping represents a standard of minimum safety requirements for: (1) the selection of suitable materials and reference to standard specifications by which they may be secured; (2) the designation of proper dimensional standards for the elements comprising piping systems; (3) the design of the component parts as well as the assembled unit including necessary supports; (4) the erection of these systems; and (5) the test of the elements before erection and of the completed systems after erection. It is intended to set minimum safety requirements expressed in language which is intelligible to all who design, manufacture, and erect piping systems, but not necessarily to cover the best practice known to the art. While in most cases the requirements are mandatory, design recommendations have been included where they will be of assistance in securing safe piping systems."

It has been found that many people do not understand properly how the American Standards Association functions, nor do they understand the relation of The American Society of Mechanical Engineers to this ASA Code for Pressure Piping. Hence it is our purpose to bring these subjects to a state of better understanding.

The American Standards Association was formed to serve as a national clearinghouse for standards activities on the national and international level. It has developed highly specialized but flexible machinery providing for the creation of a consistent set of American Standards.

At the end of the first World War there were several hundred standardizing groups in the United States, i.e., trade associations, engineering societies, government groups—federal, state, and municipal—each busily turning out standards. There was much duplication of effort, a profusion of standards on the same subject with reference to the same details, and much confusion and misunderstanding. It was as though every bank in the country acted as its own clearinghouse for all the transactions in which it participated, without reference to other banks.

Contributed by the Petroleum Division and presented at the Petroleum Mechanical Engineering Conference, Los Angeles, Calif., September 26-29, 1954, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The American Standards Association

The American Standards Association was founded in 1918 as the American Engineering Standards Committee. Its membership consisted of five great Engineering Societies, and shortly thereafter, three government departments became members.

At the same time, the National Safety Council conducted a national survey. It disclosed that a great number of conflicting rules and regulations had been established by state and municipal regulatory bodies. In addition, many safety recommendations, aimed at industrial accident prevention, had been issued by committees of trade associations. A chaotic condition existed.

The National Safety Council and the National Bureau of Standards asked the ASA groups interested in safety to undertake the program of Safety Standards and Codes. This was done and by August, 1950, ASA comprised 101 such nationally known trade associations, technical societies, and groups of such organizations. These authorize and are responsible for all aspects of ASA activity. They are the owners and operators of ASA. They are the trustees of a national institution and are responsible for the protection and maintenance of its integrity and ethical standing.

In addition, ASA has about 2000 company members. Most of them belong to one or more of the trade associations or technical societies, which are themselves members of ASA. These companies cut across all groups, interests, and industries in the nation. The dues and contributions from the Engineering Societies, trade associations, and company members, supply the working funds of ASA.

ASA is an instrument of the free-enterprise system. About 4000 executives and technical experts are now serving on committees which are developing American Standards under the clearinghouse machinery of ASA. They are giving millions of dollars' worth of time to the cause of standardization.

Functions of ASA

ASA functions are as follows:

To simplify development of engineering, commerical, consumer, and safety standards.

To eliminate duplication, overlapping, and variations of standards activities among other bodies in the country.

To weld conflicting standards into a single generally accepted standard, designated "American Standard."

To promote knowledge and use of standards.

To serve as a national clearinghouse for information on all standards in this country and abroad.

ASA is not a trade association, nor is it a technical society. It is a service organization—a federation of such associations and societies. It functions as the machinery through the use of which standards or ideas for standards may be co-ordinated.

Naturally, ASA does not compete with its members and it does not duplicate their projects. It is the organization which they have developed to co-ordinate and channel this phase of their work, as well as the work which other organizations may bring to ASA for co-ordination.

Operating in the public interest, and using procedures tried and tested over a 32-year period, ASA provides the machinery through which those who are concerned may initiate and develop standards. The association agrees to a new project only when one or more groups request it, and when there is enough support to warrant such an undertaking.

It is important to understand that ASA does not initiate any standardization project. ASA is the tool of its member organizations, serving to provide the means for developing standards desired by one or more groups. The decision to proceed with the development is made by the Standards Council, whose members act as representatives of all interests in connection with the development of the proposed project. If a project is accepted, the Council may delegate certain functions in the development of the standard to committees or groups organized within particular branches of industry or spheres of influence.

Working Principles of ASA

ASA work is guided by three simple principles:

1 Every group substantially concerned with a standard is given the opportunity to participate in its development.

2 The questions are broken down into parts small enough that each part can be handled by a committee composed of representatives appointed by the groups concerned.

3 Decisions are not made by simple majority vote. Instead, every effort is made to thrash matters out so thoroughly that decisions are unanimous, or nearly so.

Every standard, therefore, represents a true national consensus.

The committees that develop standards (called sectional committees) usually operate under the leadership (technically called sponsorship) of one or more bodies especially experienced in the field.

Fig. 1 is a chart which reproduces page 5 of the ASA Bulletin entitled, "How American Standards Are Developed and Approved." The Code for Pressure Piping is the responsibility of ASA Sectional Committee B31. The American Society of Mechanical Engineers is the administrative sponsor of the committee. The B31 Sectional Committee is responsible for the promulgation of the Code and the continuing work of interpretation and revision.

Fig. 2 shows graphically the constitution of sectional committee membership. Thirty-seven organizations are represented, all of them having an interest in pressure piping.

Petroleum Industry Representation

The Petroleum Industry is represented on the Sectional Committee by men who are appointed by API. At the present time, this petroleum representation consists of the following:

D. W. Motter, Standard Oil Development Company.
J. P. Mooney, Humble Oil and Refining Company.
N. J. Rees (alternate), Socony-Vacuum Oil Company, Inc.
W. T. Gunn (alternate), American Petroleum Institute.
R. H. Lynch, Keystone Pipe Line Company.
O. W. Heyden, Shell Pipe Line Company.
A. E. Pecore (alternate), Humble Pipe Line Company.
J. E. Moss (alternate), American Petroleum Institute.
H. W. Ladd, Stanolind Oil and Gas Company.
W. H. Strang, American Petroleum Institute.
E. O. Mattocks (alternate), American Petroleum Institute.

A review of this list of organizations indicates what a wide representation exists embracing engineering design, the using industries, the manufacturing industries, inspection, insurance, and the general public. The administrative work of the Sectional Committee is not done by the American Standards Association, but by one or more of the organizations sponsoring the sectional committee. In the case of B31, The American Society of Mechanical Engineers is the administrative sponsor and provides the committee with the staff work that is necessary over and above that which is provided by the individual committee members themselves. The American Society of Mechanical Engineers takes care of printing and distribution, and the only financial return which it receives for this work is whatever profit (if any) that may result from the sale of the documents issued by the Sectional Committee.

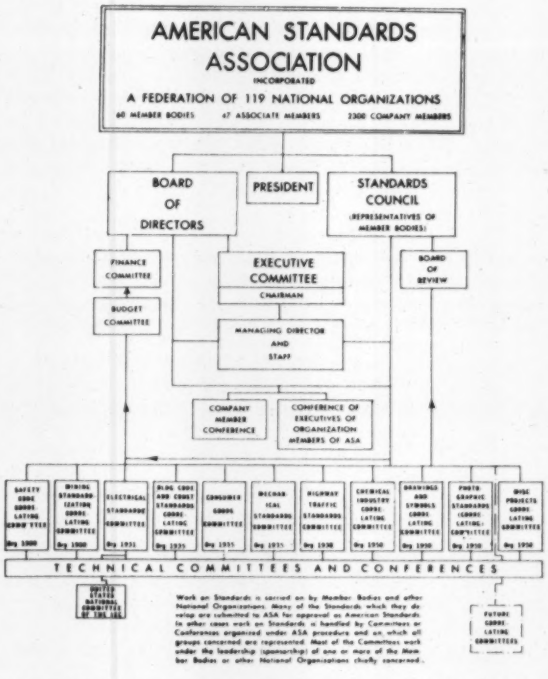

Fig. 1 Reproduction of ASA Bulletin Chart, "How American Standards Are Developed and Approved"

ASA B31

Number of Organizations Represented, 37 - Sectional Committee Sponsored by

Organizations - Personnel Made up of Representatives Appointed by Sponsors

The American Society of Mechanical Engrs	C A Kelting G Sinding-Larson	R E Sprenkle E J Wiseman
Air Conditioning & Refrig. Mchy Association	John R Schreiner E W Ervasti	
Am Boiler Mfrs Association & Affiliated Industries	John L Menson	
Am Bureau of Shipping	J W Heck	
Am Gas Association	H A Clark R G Strong	F A Hough H W Nicolson
Am Inst. Chemical Engineers	R S Roberts	
Am Inst. Consulting Engineers	H E Keeler	
Am Inst. Mining & Metallurgical Engrs	R E Crockett	H M Cooley
Am Iron & Steel Institute	H R Redington J C Siegle	
Am Petroleum Institute	D W Motter J P Mooney R H Lynch	O W Heyden H W Ladd
Am Society for Testing Materials	N L Mochel P V Reader	L H Winkler
Am Society of Refrigerating Engrs	A C Buensod	
Am Society of Safety Engrs	E Clark Woodward	
Am Water Works Association	S Logan Kerr	
Am Welding Society	R W Emerson	
ASA Electric Light & Power Group	E H Krieg	R C Fitzgerald
Association of Casualty & Surety Companies	J A Shannon	
Cast Iron Pipe Research Assoc.	T F Wolfe C A Hendrikson	J T Vann
Compressed Air & Gas Institute	R J Allen	
Compressed Gas Association	F C Saacke	
Copper & Brass Research Assoc.	A I Heim	
Heating, Piping, and Air Cond. Contractors Natl Assoc.	J H Zink	G P Nachman
Hydraulic Institute	H G Gartmann	
International Acetylene Assoc.	G O Carter	
Manufacturers Standardisation Soc. of the Valve & Fit. Ind.	L W Kattelle W P Kliment	J J Kanter
Manufacturing Chemists Assoc.	Dr. James Collins	
Natl Automatic Sprinkler Assoc.	J H Williams	
Natl District Heating Assoc.	G D Winans	
Natl Elec Manufacturers Assoc.	C D Copper	A W Rankin
Natl Safety Council	G O Carter	
New England Water Works Assoc.	T F Wolfe	
Pipe Fabrication Institute	K W Haupt	
Society Naval Arch. & Marine Engrs	H C E Meyer	
Society of Ohio Safety Engrs.	H R Redington	G R Locke
Synthetic Organ. Chemical Mfrs Assoc. of U.S.	K W Mahen	
U S Dept of Commerce National Bur of Standards	W H Seaquist (liaison)	
U S Dept of the Navy	Bureau of Ships (Code 350) (liaison) Bureau of Yards & Docks (liaison)	
Members-at-Large	Sabin Crocker L W Benoit D G Reid W W Brown	D B Rossheim F S G Williams J Roy Tanner

Fig. 2 Chart showing constitution of B31 Sectional Committee membership in which 37 organizations act as sponsors

ASA Sectional Committee B31

Fig. 3 shows the organization of ASA Sectional Committee B31 and indicates how the committee functions. The sectional committee itself is a review committee and is responsible to the American Standards Association for the contents of the documents prepared, and for review of the procedures used to make certain that all points of view have been heard and given proper consideration, and to see that basic ASA policies are carried forward.

The Sectional Committee has created an Executive Committee to simplify the administrative work. The Executive Committee consists of the chairman of each of the subcommittees, plus three members at large who are chosen either for their technical competence or for their outstanding position in the fields of safety and engineering.

Until recently, the Code for Pressure Piping consisted of six major sections, each of which is devoted to one type of service. For example: Section 1, Power Piping; Section 2, Industrial Gas and Air Piping; Section 3, Oil Piping; Section 4, District Heating; Section 5, Refrigeration, and Section 8, Gas Transmission and Distribution Piping. In addition to these major sections, that are identified by service use, there are technical service subcommittees, such as, Subcommittee on Fabrication; the Subcommittee on Standards and Identification; the Subcommittee on Materials and Stresses; the Subcommittee on Instrument Piping; and the Subcommittee which is charged with maintaining

Fig. 3 Organization chart of ASA Sectional Committee B31 showing how committee functions

liaison with other code-writing and standards bodies.

In March, 1954, the American Petroleum Institute recommended to the Sectional Committee that Section 3 be limited to oil piping within refinery limits, and a new section be formulated to cover oil-transportation systems. This recommendation was approved and a new committee has been formed to develop the oil-transportation section, which will be known as Section 9.

Again in March, 1954, the chemical industry, acting through the Chemical Industry Advisory Board (CIAB) of ASA, recommended the establishment of a separate section dealing with chemical-industry process piping. This recommendation also was approved and a new committee has been established to develop this section, which will be designated Section 11.

Membership of Committees

When the sectional committee was reorganized in 1948, it took action to establish two classes of membership on the subcommittees, namely, "active" and "corresponding." The active members are the only ones who have a vote that is tallied on final letter ballots. The corresponding members receive copies of all correspondence, attend meetings, and express their views at all times. The background of this "corresponding membership" stems from the need for getting reasonably prompt action within the committee, combined with the fact that many who were interested in the work in the past had been only mildly interested and a large voting committee made it hard to get prompt action.

Although the men serving on the Sectional Committee are appointed by their respective organizations, the rules of ASA provide great flexibility in the selection of subcommittee personnel. This is a very wise procedure, since it permits the selection of men who are most technically competent in their respective fields whenever the need arises.

Letter Ballot

The next item that should be understood is the letter ballot. All committees and subgroups work under the normal rules of order for committee procedures with voice votes being taken. When, however, a consensus on some particular subject has been reached, the decision must be put in writing and submitted to all members of the committee involved. The members vote on specific wording through the medium of the "letter ballot." This does much to eliminate misunderstanding and makes certain that material passed along by a subcommittee for approval is exactly in the form and language upon which agreement exists by the written record of the letter ballot. This provision is important because it eliminates any misunderstanding or chance of error.

The chairman of a subcommittee, in reporting his recommendations to the Executive Committee, always does so with a statement of the number of affirmative and negative votes. When negative votes exist at the subcommittee level, the chairman must brief the negative votes and the reasons given for the negative votes. Although cumbersome, this system has worked well in the past, and provides a positive means of making certain that where unanimous consensus has not been reached, the views of the minority have been given proper and careful attention, and that the majority has had sound reason for its position. While there are no hard and fast rules on the subject, a subcommittee seldom, if ever, submits a proposal to the Executive Committee with more than a very scattering number of negative votes.

Suggestions for revisions to various code sections may come from any source, either within the subcommittee, from members of the Sectional Committee, or from the general public. They may be directed to a member of the subcommittee, to one of the chairmen, to one of the officers of the sectional committee, but the preferred method is to address the suggestion to the Secretary of the Committee. Suggestions originating from a source outside of the subcommittee involved are transmitted to the chairman of the interested subcommittee for study and recommendation.

If the idea is considered to have merit, we will presume that it is acted upon and eventually submitted to the Executive Committee by the subcommittee chairman as a proposed revision for adoption. Upon passage by the Executive Committee, it is automatically distributed in writing to the members of the Executive Committee and the sectional committee for letter ballot. Upon approval by the letter ballot of the sectional committee the administrative sponsor (the ASME) transmits the recommended revision to the American Standards Association, where it is first acted upon by the ASA Mechanical Standards Committee, and from there it goes to the ASA Board of Review, and finally, is approved by the ASA Standards Council, at which point it becomes an official revision to the Code. This sounds very cumbersome and could take an inordinate amount of time, but in recent years, proposed revisions and new standards usually have been cleared in approximately 60 days after they are submitted by the Sectional Committee administrative sponsor.

Interpretations

From time to time, matters arise which require prompt action. These may fall in the category of revisions necessitated by advances in the art of design or fabrication, new materials, inadequacy of a code section, and so on. When the Executive Committee feels that the question is of sufficient importance to warrant immediate action, an interpretative case is issued. These "interpretations" or "cases" usually stem from inquiries received from the outside and they are, of course, processed through the proper subcommittee. As soon as the case has been approved by the Executive Committee by letter ballot, it is published in MECHANICAL ENGINEERING and can be used by anyone. However, it cannot become a mandatory requirement of the Code until it has been cleared by the whole Sectional Committee. The "case" gives the users of the Code and the inspecting authorities a prompt ruling. The action outlined in the case is then worked into the Code as a revision.

Since 1948, 15 cases have been issued, and in 1953, Supplement No. 1 was distributed. This Supplement included extensive changes to the table of allowable working stresses and also included numerous changes in the text of the various sections. The subcommittees have been working to complete revisions and it is expected that a new edition of the Code will be issued early in 1955. The most significant changes in the 1955 edition will relate to Section 6, dealing with Fabrication Details, Welding, and Flexibility.

Professional Self-Development *of Engineering Administrators*

By J. E. Walters

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The impression is rather general that engineers may not be good administrators because of their interest in machines and physical things. This in spite of the fact that as early as 1933 it was found that three fifths of the engineers, 20 years after graduation, were engaged in functions which could be classified as administrative (1, 2).[1] The author gives the background of what is necessary as the basis for a good program of professional self-development in engineering administration and then outlines in detail the steps essential to achieving success in this field.

Good administration is essential to any and every good organization. No company can progress without progressive administrative personnel to plan, organize, co-ordinate, control, direct, and measure it. The quality of the administration determines whether it is the creative force, the leveler, or the retarder of progress. The kind of administration usually determines the quality of the organization—its goals, policies, methods, and accomplishments. In every company the board of directors and the top management need to be concerned constantly with, and actually doing something about, the quality and development of its administrative personnel.

Better Managers Needed

Many companies are decentralizing their management functions, placing more responsibility upon the individual managers. This requires better managers and a better development of them in those positions so that they can stand on their own and assume the greater responsibility.

Specialization has caused many executives to concentrate on their particular function to the neglect or omission of the broader management functions, such as overall planning, organization co-ordination, direction, and control of the various functions which top management can give. Some managers have been appointed to their positions with a limited number of the qualities and experience needed but lacking in others. If the experience and latent abilities were developed in those managers they would be better managers in their present jobs. A good management-development program can fill the gaps in the experience and training of those present managers, as well as improve the latent qualities in them for more responsible positions.

Managers Are Born and Made

Some people contend that managers are "just born that way." However, experience shows that managers are both born and made. Good managers can be improved by development and medium ones can be trained to manage better. A poor manager may not be made into an excellent one but he may perform his present job better as a result of training.

The systematic method of management development endeavors to take advantage of both inherited abilities as well as the development of latent and acquired ones. Haphazard methods of letting managers develop under given conditions are not so good as systematic management development which provides the best conditions for managers to develop and progress. Good management soil and climate are necessary for top management to grow. Managers are highly individualized human beings and need to be treated as such in order to accomplish for themselves and their organization.

Techniques of Management Development

Some of the companies which have good executive-development programs, in the author's opinion, are as follows: Standard Oil Company of New Jersey (3); Westinghouse Electric Corporation (4); Sears, Roebuck and Company (5, 6); Monsanto Chemical Company (8); Johnson and Johnson Company (9, 10); Consolidated Edison Company of New York (11).

Other companies include: Standard Oil Company of California, The Detroit Edison Company, The United States Rubber Company, General Foods Corporation, Otis Elevator Company, United Parcel Service, and Bigelow-Sanford Carpet Company.

From a study of the management-development programs of these companies and others, the essential steps of a good program of management development which the top manager of a company can follow are as follows:

1 Investigate and visit the executive-development programs of other companies and study the literature in this field.

[1] Numbers in parentheses refer to the Bibliography at the end of the paper.

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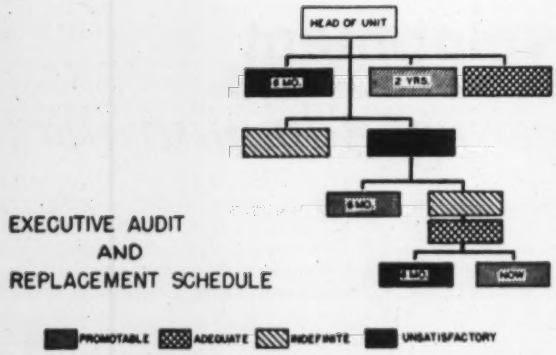

This chart showing the "Inventory Control Method" is taken from "Personnel Administration at the Executive Level," by N. G. Asbury and staff, published by the United States Naval Institute, Annapolis, Md., 1948 (7). (As reproduced by the National Industrial Conference Board, Company Programs of Erection Development, 1950.)

2 Investigate and find out what is being done at present on executive development in this company, both informally and formally.

3 Develop and write a policy of executive development adapted to the needs of this particular company.

4 Define the methods to be used in actualizing the executive-development program, "tailor-made" to fit this company, put them into effect, and carry them out. The following is a general outline of such methods devised from those of the foregoing companies and from other sources.

Methods of Executive Development for Top Management

1 Ask each executive to prepare:

a A description of his position—giving full details of the policies, standards, duties, relationships, and plans for improvement of his positions with an organization chart of his department or departments, including all management positions which are under his administration.

b A personal record giving his experience, education, personal information, and anything that has a bearing on his position, his management work, and development.

2 Develop an ideal organization for the company—improve the job descriptions, personnel specifications, organization charts, giving them as they should be in order to accomplish better the policies and purposes of the company. Just an organization chart is not enough. It's the tone and quality of that organization that counts. It's what is back of the chart, from a personnel standpoint, that is important.

3 Appraise how well the present executives are performing the functions and are meeting the specifications of what they are and should be doing. Rate each executive on how well he is performing the duties of his present position, how well he is performing the general-management functions common to all managers, such as planning, organization, co-ordination, administration, and control, and how well he meets the personal characteristics determined to be generally needed by a manager of this company. This rating may be done by three executives of the company and discussed by them in detail.

4 Prepare descriptions of possibilities for each executive and charts of progression both for his development in his present position as well as preparation for positions and work of greater responsibility.

5 Discuss with each executive his ratings, obtain his opinion, and work out with him a program of development which will help him perform his present duties and functions better, improve his functions and personal characteristics, if it is possible to do so, and prepare him for the added responsibilities as determined.

6 Provide the opportunities and methods for him to develop. The following is a list of those found in the companies mentioned:

a Observation, suggestions, and guidance on the job calling for added broad information about the job and the work of the department, and particularly the company as a whole.

b Assignment of special projects and reports which will take study and work beyond the confines of his job and which will help promote and broaden the work of the department and company. Ask for periodic reports on progress and plans.

c Development of "assistant to" understudy, and special trainee positions for appointment, to broaden or give desired experience. Broaden job content for given jobs. Provide sponsor plans, where some other executive sponsors the development of special experience of abilities. Consider multiple management or a management cabinet.

d Appointment on committees for subjects that will cause the members to obtain broadening experience and knowledge. Have executives attend special staff and other meetings and conferences.

e Rotate the executives in different positions in the company in order to give the needed varied experience.

f Distribute reading material on the desired subject, management articles, and technical bulletins; also, full information on company policies, methods, and other subjects.

g Provide individual instruction demonstrations and counseling to give the desired experience and skills under direct observation and examples; ask for special inspections of work in the company and for reports on it. Make observational assignments in the company and other companies.

h Provide training courses within the company which will supply the needed management, technical, personnel, marketing, economical, social, and other information and experience desired and needed. Provide opportunity for public speaking and the presentation orally and in written form of subjects assigned.

i Provide opportunities for the selected executives to attend meetings, conferences, and conventions of professional and technical societies, services, and schools and colleges; advanced management courses in universities such as at Harvard and the University of Pittsburgh; and industry and management association services for managers.

j Encourage visits to other companies for both special and general management information, experience, and skill; participation in the management of community activities.

k Consider the use of consultants to assist with management development. Provide physical examinations and a health program for executives.

l Consider travel to broaden management experience; assignment to headquarters; luncheon, dinner, evening and special group meetings of executives to broaden acquaintance and knowledge.

m Invite selected speakers from outside the company who are authorities on the desired subjects to bring the best information on the subjects.

n Assign executives to teach company training courses for employees and others. Provide special incentive plans to encourage extra participation and grant executives extra rewards such as extra vacation, and so on.

7 Continual counseling with each executive on his progress of development.

8 Advance those executives, who have improved, to the better positions as they become vacant, and as those executives are developed.

9 Follow up promotions to see that the personnel in all positions in the company are performing adequately, by means of periodic checks and counseling.

10 Evaluate the program to see if it is accomplishing its purpose and good results.

Advanced College Management Courses

In recent years the universities have been developing advanced management courses for executives and managers from industry and business. Two of the early and notable ones are those at the Harvard Graduate School of Business Administration, and the School of Business Administration at the University of Pittsburgh (12).

Other universities have had and are developing advanced management courses. The Massachusetts Institute of Technology has had, for a number of years, the "Sloan Fellowships Program for Executives" for managers who have had a number of years' experience in management in industry and who go in residence at the Institute for a year of study of the various phases of management. The Wharton School of Finance and Commerce at the University of Pennsylvania has an "Executive Conference on Coordination and Policy Formation" of two weeks.

The management-development courses at the universities endeavor to give to advanced managers a general over-all viewpoint of management principles and problems which will give them an outlook beyond their own specialization. The value of these courses to the companies has been shown by the increased demand for them. A number of colleges and universities are considering developing such programs.

12-Step Program of Professional Self-Development for Engineering Administrators

What might a good program of professional self-development in engineering administration for engineers and engineering administrators be?

First, it must be done largely by the engineers themselves similar to executive development in industry; and second, each company must provide the inspiration, the leadership, the circumstances, and wherewithal for each engineer or engineering administrator to develop himself. If a company cannot do this latter, then it can ask the state university to provide a course or a refresher course in Engineering Administration for its engineers, especially its engineering administrators. This has been done and is described in the following.

From the executive-development programs in industry what should such a course contain for these administrators?

Engineering administration can be defined simply as (1) planning, (2) organization, (3) co-ordination, (4) direction, (5) control, and (6) the measurement of results of engineering administration.

1–2 Planning—Plan Scientifically. In engineering, planning is the determination of engineering policies and application of scientific methods to the solving of engineering administrative problems. In many companies this latter item means "engineering research methods." Step 1 in professional self-development, therefore, would be the preparation by the engineer of his engineering policies—his guides to action, the purposes and objectives toward which he is striving, and the reasons for them, and the writing of them for his own self-development.

Step 2 is the determination, clarification, specification, and improvement of his methods of research and investigation. He needs to re-examine these methods and to write and improve them.

3 Organization—Develop an Excellent Organization.[2] Each engineer can write or prepare a good description of his position and his work—describe the specific duties of his position. The position descriptions of all the engineers or managers can be made into an administrative manual and all organization charts combined into a general organization chart.

4 Co-Ordination—Co-Ordinate the Different Departments Into a Co-Operating Unit. Each administrator is asked to describe the duties and functions which he performs with each of the other administrators and how that co-ordination and co-operation can be improved. Descriptions of the interrelationships are then drawn up and approved as a guide for improved interrelationships —co-ordination and co-operation.

5 Administrator Appraisal—Make Administrative Personnel Specifications and Ratings. Rating scales developed for rating how well the specific duties and the general administrative functions are performed and how good each administrator is on the characteristic considered by the group of administrators as essential for that company.

Each engineering administrator can be rated by three other managers.

A program is agreed upon for his development by such means as assignment of special projects and reports to company committees, job rotation, special assistant-to positions. Study of literature on the subjects needed, advanced courses in universities, visits to other companies, and the various other means of executive development are considered. Constant observation and instruction, especially on the management functions, are given until promotion is made or difficulties are corrected.

6 Administrative Simplification—Simplify Administration Methods. Administrative-process flow charts can be made for the various administrative functions. Each administrator can make an administrative process chart for the principal administrative functions which he performs, especially those to be improved, and simplify as many of his administrative methods as possible.

[2] Step 3 and following steps given in outline form; for further details see complete ASME Paper No. 54—SA-63 or write to author.

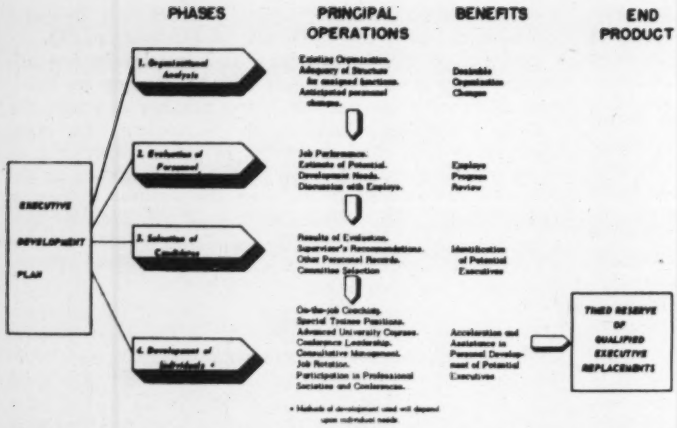

Diagram of the management-development program of the Monsanto Chemical Company

*7 **Administrative and Engineering-Employee Morale—Build Better Morale.*** Ask each administrator to answer questions by interviews or by questionnaires without signing, giving his opinion on the things considered essential to good morale in this company. Further questionnaires can be prepared and all employees asked to answer. From a tabulation of the results, compared to the results of the administrator's survey, have the administrators correct the sore spots and improve the others.

*8 **Reward Administrators' Ideas and Effort Fairly, or Pay Administrators Fairly.*** Discussion of the methods of evaluating administrative positions in the company and development and determination of the administrative factors which distinguish the worth of one administrative position from another can be made. Degrees for each of those factors can be developed into a measuring guide of all of the factors with which the positions can be evaluated. Each administrator can describe the degree to which his position requires each of the factors and evaluate his position on all of the factors, total the points for all factors, and present the evaluation to his executive or administrative-evaluation committee.

*9 **Select Administrators Carefully for Administrative Characteristics.*** Consider improvement of interviewing and counseling, psychological testing, administrative-personnel records, salaries, and so on. Develop several possibilities for each management position. Make personnel comparison of those personnel possibilities and select the best.

*10 **Train the Administrator to Train Supervisors and Other Managers.*** Consider the individual training and development needs of each administrator and discuss them and counsel with him and develop an individualized training program with him. Use as many as practical of the various methods of training managers—coaching, the conference method, role-playing, visual aids, training courses in the company, advanced management courses in the colleges and universities, and the like.

*11 **Improve the Counseling and Interviewing of Administrators.***

*12 **Check Each Administrator's Administration of Personnel.*** As each administrator needs to practice the administration of personnel more than half of his time, then there should be a periodic audit of it for each. Compare the turnover, absenteeism, grievances, suggestions, accidents, and other means of judging the quality of personnel administration of the different administrators. Improve his personnel administration.

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Economical Turbine Design for Marginal Hydroelectric Plants

How to make obsolete or uneconomical plants profitable

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WITH the advent of large hydroelectric and thermal plants tying into extensive networks, many potential hydro sites remain undeveloped because they are marginal in nature and cannot be developed economically along standard lines. In other instances, water-power sites which were developed years ago are becoming too costly to operate because of antiquated equipment but may not be abandoned.

In the face of such problems steps must be taken to reduce capital and operating costs in order to utilize many of these presently marginal sources of hydroelectric power.

Each hydroelectric project requires individual study. Unlike thermal plants where operating conditions and capacities for steam turbines have been standardized substantially, hydroelectric plants must be designed to suit conditions peculiar to each case. Since the operating heads may vary over a considerable range, and the available flow change month by month and year by year under various storage conditions, it is quite obvious that each project produces a new combination of requirements.

Whether a plant is existing or still in the planning stage, the type and composition of the equipment will depend largely upon the type of load to be served. It may be a base-load plant which is merely producing kilowatthours without regard to load fluctuations; it may be a peaking plant operating only during time of maximum demand on a system; or it may be serving to take care of the normal fluctuations. Economies in varying degrees therefore may be made so that each plant serves its useful purpose. Various design features and expedients can be incorporated by hydraulic-turbine manufacturers, some of which will be described.

Basic Requirements

The capacity of each unit in a given station will be determined, of course, by the head and discharge available, water-storage potentialities, and the economical balance between over-all cost of the structure and hydrogenerator and control equipment. In general, the highest practical generator speed should be adopted, since it reduces the size of the equipment, the foundation, and building requirements. There are exceptions to this, however, because in so doing, the higher-speed turbine will have to be set at a lower elevation with respect to tail water and may increase foundation costs beyond the alternate cost of a slightly larger powerhouse, as well as aggravate pitting and vibration problems in operation.

Lower speeds, on the other hand, are worthy of consideration in the reconstruction of older existing plants. Because most of these "old timers" were installed prior to the advent of the propeller-type runner, Francis runners were used with short very inefficient draft tubes and usually were set higher above tail water than is found suitable today. Consequently, the draft-tube chamber is shallow and is frequently difficult to deepen today because of the hazard of disturbing the powerhouse foundation. Under such conditions, a new turbine, speeded more conservatively, could eliminate, or at least moderate, the foundation problem.

Naturally, it is desirable that every plant operate at the highest possible efficiency. Here, again, an economical balance must be sought, for it may cost more to attain that high efficiency than the gain in capitalized value of the additional energy. Such thoughts should be especially borne in mind when planning the reconstruction of draft tubes in old powerhouses. The attainment of higher present-day efficiencies is more easily accomplished in new plants since we are not inhibited by the additional limitations of an existing structure.

The determination of proper capacity of each unit in a reconstruction project is frequently difficult. Many of the earlier developments did not utilize stream flow to the best advantage and wherever practical this should be done. On the other hand, although a greater flow might be utilized, the cost of installing new intakes and penstocks in place of the old ones could increase the plant cost beyond the point of best economy.

Simplifying the Hydraulic Turbine

Many economies may be effected in different instances by simplifying the turbine equipment. Frequently a butterfly valve is installed between a turbine and penstock for the purpose of reducing gate leakage when the turbine is shut down between normal operating periods. In some cases this valve can be omitted and the turbine provided with rubber seals above and below the wicket gates and at the contact line between gates.

This has been done with complete success on such turbines as the 34,000-hp, 135-ft-head units at the Wyman

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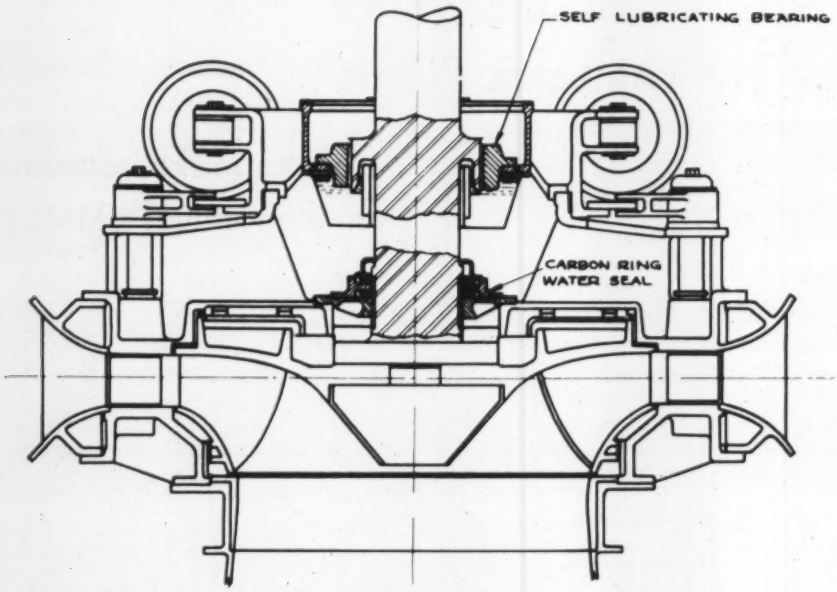


Fig. 1 Cross section through hydraulic turbine showing self-lubricating bearing and carbon-ring water seal for Francis unit

Plant of the Central Maine Power Company, the 10,700-hp, 92-ft-head units at the Peavey Falls Plant of the Wisconsin-Michigan Power Company, and the 91,500-hp, 330-ft-head Fontana turbine of TVA. These machines were installed in 1931, 1943, and 1944, respectively, and the sealing devices in all of them are still as effective today as they were at the time of installation. This construction may not be advisable, however, if two or more units are connected to the same penstock, for it would require complete shutdown of all units in case of necessity to unwater any one.

Simplification of turbine-bearing lubrication, in many cases, will reduce initial and operating costs in unattended stations. Grease-lubricated or water-lubricated bearings frequently can be used in place of the forced-oil type. Or in other cases, the self-lubricated oil type may be used to eliminate auxiliary devices completely, Fig. 1. This type, long used for the lower bearing of water-wheel generators, eliminates separately driven oil pumps, auxiliary controls, and numerous protective devices necessary with a separate pumping system. It also does away with sequence control required to place the pump in operation before the turbine is started, for the self-lubricating type is partially immersed in oil at all times. It starts pumping oil as the turbine starts and increases the supply until normal speed is reached. In general, only temperature and oil-level protection devices are necessary.

As another means of reducing turbine costs for the marginal plant, consideration should be given to simplifying the wicket gate and control mechanism. If the turbine is to be operated without the necessity of controlling frequency, it is possible to eliminate standard governor equipment and substitute a motor-operating device for the gate mechanism with suitable limit switches and motor-operated load-limiting device. Control would be relatively slow, but other than experiencing runaway speed in case of loss of load, most other operations can be controlled. The unit can be automatically started, placed on the line, the load limit adjusted, and the unit shut down by conventional means.

On larger-size turbines, where an electrically driven wicket-gate operator would be impractical, oil-pressure-operated servomotors can be controlled by a motor or oil-operated control valve to eliminate the more expensive governor equipment. An oil-pressure system, consisting of oil pump and motor with usual controls, and pressure and receiving tanks, still would be required. Since the unit would not be used for regulation, the operating time can be increased, thus reducing the size of the pumping equipment and lowering its cost. Such simplification, where practicable, has the further advantage of reducing inspection and maintenance time, and of course operating cost.

Turbines Without Wicket Gates

This type of simplification can be carried further by eliminating the wicket gates entirely and providing only fixed stay vanes to direct the water to a propeller or to a Francis-type runner. Such an arrangement eliminates not only the wicket gates, but obviates the need for such other equipment as the gate mechanism with its levers, links, gate-operating ring and governor, or other controlling medium. The turbine then operates at the fixed position of the normal best gate by positioning the stay vanes properly during design and manufacture. The output will be constant at any head. Variation in head of 20 to 25 per cent above or below the design value will not affect its efficiency seriously, because best gate opening does not change materially over that range on most of today's modern runners, both propeller and Francis types.

The application of this design is, of course, limited to installations not requiring load regulation but the unit can be placed on the line or removed from it as water

availability or load demand requires. When substantially constant river flow must be maintained, this design can be used to excellent advantage. It also can be used properly when limited storage is available and the plant operated during peak-load periods or to maintain water levels within prescribed limits.

Turbines such as these would require some other means of admitting and stopping the flow of water to them. For low-head installations, such as open-flume type or concrete spiral-casing type with large entrance areas, this control would be by means of head gates. Whether the turbine utilizes a Francis-type runner or propeller-type (either fixed or adjustable blade) the unit could be started and stopped by this means. Starting can be accomplished by raising the gates a preset amount, as determined by initial tests at the plant, to bring the unit to its normal speed, and placing the generator on the line by means of centrifugal switch control. The head gates then could be opened fully to load the generator to the full turbine capacity at the available head and operation would continue just as though it were a conventional turbine operating at blocked load. Normal shutdown would be effected by closing the head gates and the generator would be disconnected from the bus when zero output was reached.

No Attendant Needed

An interesting example of this type of arrangement is in operation at the Lower Paint Dam Plant of the Wisconsin-Michigan Power Company. Here, because virtually all of the water is diverted to another river, the power company was required to supply a constant flow of 85 sec-ft in the Paint River below the dam to maintain fish life and scenic beauty. This water discharges through a small horizontal fixed-blade propeller-type turbine rated at 155 hp, at 533 rpm, and 20 ft net head. The turbine, Fig. 2, has no wicket gates and, to provide further simplification, the fixed vanes were made radial to support the turbine main bearing. Water discharging from the runner passes through a 45-deg elbow and a straight conical draft tube to the tailrace. The outboard end of the turbine shaft is supported in a bearing where it emerges from the draft tube and connects to a 100-kw, 514-rpm induction motor serving as a generator. Both bearings are rubber-lined and water-lubricated.

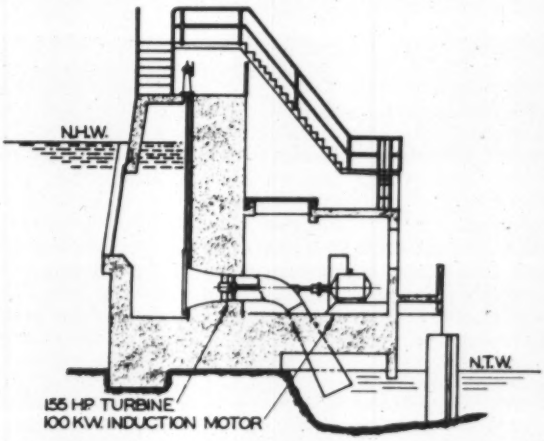


Fig. 2 Simple design for small turbine for use without wicket gates and governor—adaptable to marginal plants

The turbine is started by raising fully the manually operated head gate, whereupon the unit immediately accelerates to runaway speed. A standard 150-hp starting cabinet then throws half-line voltage on the generator and the machine speed immediately drops to slightly above synchronous value. After a short delay full-line voltage is applied and the full turbine output is absorbed by the generator. In case of line failure the breaker opens and the unit runs at runaway speed until the load is restored or the head gate is closed manually. Since both generator and turbine were designed for prolonged runaway speed, no damage results.

This station is completely unattended except for a weekly inspection by an operator from another plant 7 miles away. A head-water-level recorder provides the only other contact with the Lower Paint unit. During its first year of operation, this plant generated approximately 800,000 kwhr at a low cost and demonstrates the feasibility of low-cost design.

Inlet Valve For Starting and Stopping

For higher-head installations in which water is delivered to the turbine by means of a penstock, the flow

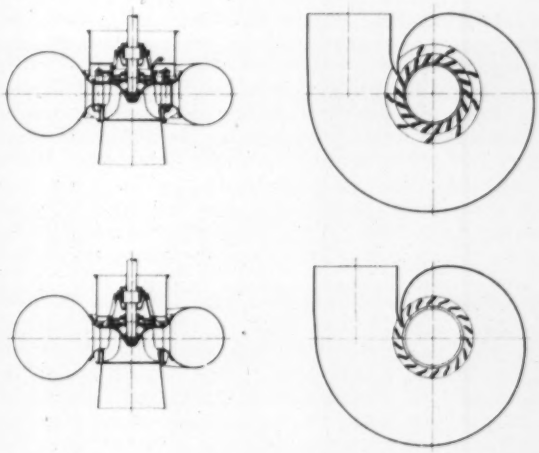


Fig. 3 Comparison of Francis-turbine design with wicket gates (*at top*) and without wicket gates (*at bottom*)

can be controlled effectively by a butterfly or other conventional type of valve suitable for operations under full flow conditions. A turbine without wicket gates can be started readily by opening the main valve a small amount to bring the unit to something less than synchronous speed and the final speed adjustment effected by means of the auxiliary by-pass valve. A centrifugal switch then can be used to close the breaker, or if desired, a synchronizing device can be used to trim the motor-operated by-pass valve for exact speed adjustment.

Costwise, a turbine without wicket gates and without governor represents a saving of 20 to 30 per cent of the cost of a conventional unit. Furthermore, its over-all dimensions are reduced, Fig. 3, to permit a reduction in the size and cost of the powerhouse. Maintenance and inspection time of a mechanical nature is practically eliminated because only the main shaft, runner, and inlet valve constitute the movable parts of the machine. Because of its simplicity relatively few protective de-

vices are required, thus contributing further to capital and operating-cost reduction.

The elimination of wicket gates from a turbine does not preclude the use of an adjustable-blade-propeller type of runner for plants within the permissible head range. In some instances the manually adjusted type of blade-operating device probably will be the most practical, while in others the automatically operated design can be used to good advantage. An actuator-type governor would be required if the unit is to be used for load or flow regulation. For less frequent or periodic control of

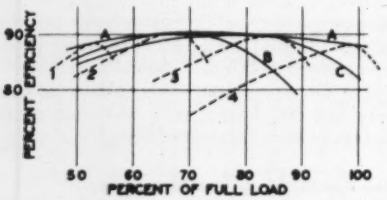


Fig. 4 Typical power-efficiency curves for Kaplan turbine

the blade setting a motor-operated limit switch and hydraulic control valve or load-limit device could be used, as described previously for wicket-gate operation under similar conditions.

Changing the pitch of the blades varies the output and discharge even if the wicket-gate openings remain constant, so a turbine of this design can be utilized when some load or flow adjustment must be provided. However, because the best efficiency at each blade tilt does not always correspond to the same gate opening, some sacrifice in over-all efficiency must be expected, but the saving in cost and operating expense may be justified.

Fig. 4 is a typical curve of power versus efficiency of an adjustable-pitch-propeller runner. Curves 1 to 4, inclusive, represent the performance at certain pitches, respectively, and at different gate openings. When this runner is used in the conventional Kaplan design the position of the wicket gates is automatically correlated with the blade pitch, by means of cams in the adjusting mechanism, to operate at the point of best efficiency for each blade position. Curve A then represents the normal performance of the machine. When, however, the wicket gates are held in a fixed position either by blocking them or by substituting noncontrollable vanes, the efficiency curve due to changing blade position will be drawn through points on curves 1 to 4, inclusive, which represent that constant gate opening, as shown by curves B and C.

Curve B has been drawn to correspond with that gate opening which gives the same maximum efficiency as would be used in the conventional Kaplan design, with the result that the efficiency drops considerably at the steeper tilts while there is little deviation at the flatter tilts.

Curve C, representing a relatively larger fixed-gate opening, improves the steeper-tilt operation but causes some sacrifice in maximum efficiency and at the flatter tilts. Below half load, the efficiency of the unit drops rapidly, so in most cases it would not be too practical to operate for long periods below this value. Consequently, a turbine with fixed gates can be designed to favor the conditions of operation to give best over-all performance under given plant conditions.

Reducing Plant Labor Costs

One of the largest items of expense in the operation of a hydro plant is labor. It may well be that the difference between operating the station at a profit or at a loss is represented in this account. Fortunately, there is a wide variety of equipment today which can be used to eliminate many persistent tasks around a plant, or to perform some of them from another station some distance away.

Attendance required by the mechanical portions of equipment can be simplified by installing manual or automatic lubricating equipment for gate-operating mechanism of the turbine, or as described in the foregoing, by eliminating the gates and gate mechanisms entirely. Self-lubricating turbine bearings require no auxiliary pumping equipment which in itself requires regular inspection. A carbon-ring type of water seal around the turbine eliminates the need for periodic adjustment and the danger of improper adjustment as can occur with a conventional stuffing box.

In addition, the installation of automatic, supervisory, or remote control will reduce materially the number of attendants at the station or eliminate their continuous attendance entirely. With a station controlled or supervised by operators at some reasonably distant attended plant, only periodic inspection will be required. One traveling operator or maintenance man can take care of at least several plants as is presently done by many power companies.

Where favorable conditions exist, a marginal plant can be operated automatically by means of float-level control or by time switches to different loads throughout the day or week. As operating conditions change, such settings can be reprogrammed by the next regular visit of the attendant. In this way the number of remote-control functions can be reduced to a minimum.

Inasmuch as a great variety of control equipment is available today, care must be exercised in order to prevent overcomplication and added expense. In other words, auxiliaries and controls should be limited to those which are basically necessary. Remote annunciation of emergency shutdown should be limited to the operation of its master relay, instead of each separate alarm, since it already will be necessary to send a man to the plant before the unit can be started.

Economy in Marginal Plants

Although conventional designs of hydraulic turbines and auxiliary equipment have been too costly for the economical development of many marginal hydroelectric plants, numerous practical modifications can be made to reduce their original cost without sacrificing reliability or long life. Practically none of these modifications represents recent development but with the general trend toward high unit capacities for ever-larger projects, less attention has been given to the development and rehabilitation of small and medium-capacity sites which could produce many kilowatthours per year. Utilization of such economical designs, as have been discussed herein, together with other additional cost-reducing arrangements which can be contributed in building construction, generating, and automatic-control equipment can result in profitable investments. Many utilities may find such reconsiderations worth while.

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Associate Editor*

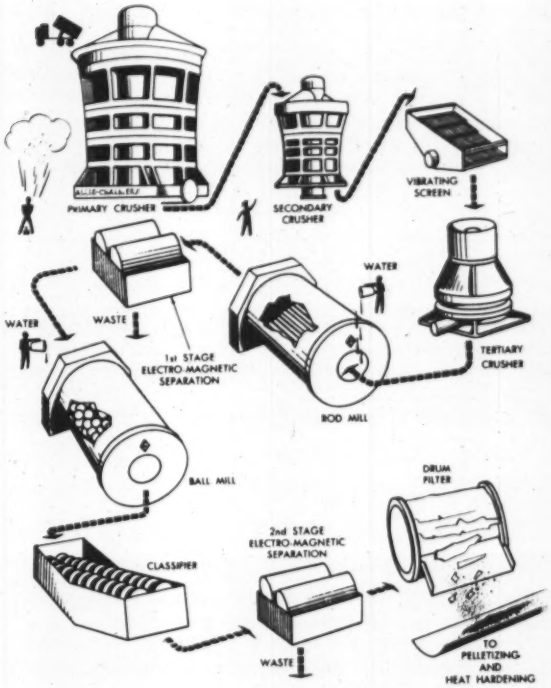


Fig. 1 Taconite concentration. Pictorial flow sheet of how taconite is concentrated from 30 to 35 per cent iron to 60 to 65 per cent by the magnetic-separation method is shown here. From the drum filter in the lower right, the iron concentrate goes to the pelletizing and the heat-hardening process.

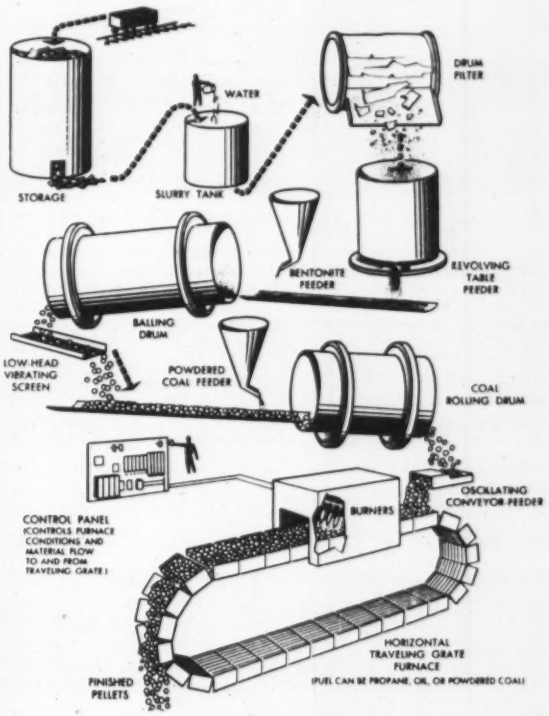


Fig. 2 Taconite agglomeration. Pictorial flow sheet of pelletizing and heat-hardening process. Results obtained at this pilot plant led to the full-scale commercial horizontal traveling grate now in operation on the Mesabi Range. Seven more full-sized units are scheduled for the E. W. Davis plant.

Taconite Pelletizing Plant

A NEW process for the heat-hardening of pellets made from taconite iron-ore concentrates has been developed by Arthur G. McKee & Company, Cleveland, Ohio, and Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

An order for the design, engineering, and materials for a new plant, incorporating the process, has been received by the McKee Company from the Reserve Mining Company for its new E. W. Davis Works at Silver Bay, Minn. It is estimated that this plant will cost around $19,000,000 and, when in full operation, will turn out 12,000 tons of pellets each day.

As cited by the developers, the major advantages of the new metallurgical process for converting powdered-taconite concentrate into an iron ore suitable for use in a blast furnace include: Its extreme simplicity of operation; the utilization of heat recovered from the operation; ease of quality control resulting from the ability of the operator to see what is going on during the process; the direct and simple discharge of the product from the equipment; and the minimizing of breakage of the pellets because of their stationary position on the grate which carries them through the furnace.

Upgrading Taconite

Taconite is the general designation for an iron-bearing Minnesota rock through which are dispersed fine particles of iron oxides firmly attached to the rock material. Industry has known for years that these low-grade ores could be upgraded by several means, including magnetic separation and flotation.

It has also been known that, to make this possible, it was first necessary to grind the taconite rock to a fine powder to liberate the iron particles from the parent taconite. After concentration by either the magnetic

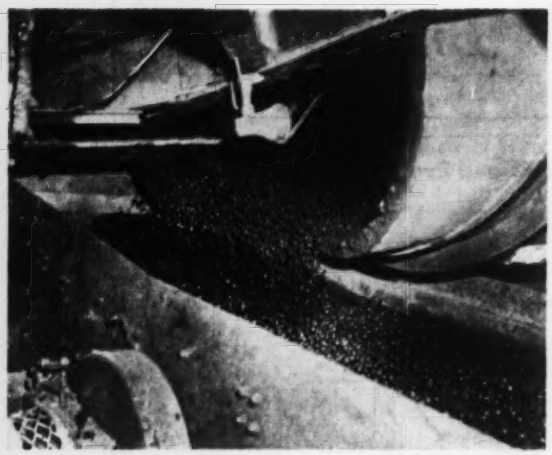


Fig. 3 First step in the pelletizing and heat-hardening process shows balls being discharged from the balling drum and falling onto a vibrating screen where the undersized ones are being removed. These are returned to the feed end of the balling drum where they act as seed pellets in furthering the formation of balls. From the screen the balls are carried to the furnace on a traveling grate.

or flotation method, it was obvious that this fine powder still could not be used in a blast furnace to make pig iron for use in producing steel, because the strong air currents in a blast furnace would blow the powdered concentrate right out of the furnace.

The new process deals with the reconstituting of the fine powder into larger-sized materials that can be used satisfactorily in a blast furnace.

The Minnesota taconite rock contains approximately 35 per cent iron oxides, 5 per cent iron carbonates, 20 per cent silicates, and 40 per cent "gangue" material. After concentration and agglomeration a product containing between 60 and 65 per cent iron is obtained, as against 50 to 52 per cent usually found in the direct-shipping ore from the Mesabi range.

The successful development of the new metallurgical process for heat-hardening the pelletized concentrate resulted from several years of fundamental research by the Allis-Chalmers Research Division, followed by extensive pilot-plant testing of the process by engineers of Allis-Chalmers and the McKee Company. During the pilot-plant phase of this development, hundreds of tons of concentrate were processed into pellets in a small pilot plant at Carrollville, Wis.

Since Reserve Mining's much larger plant at Babbitt, Minn., was started last February, thousands of tons have been processed each month, utilizing the new process. This plant is capable of producing 1000 tons of pellets a day. The McKee Company designed the pelletizing section of this plant and assisted in supervising its construction.

Process Description

The new process is based on the utilization of a horizontal furnace, approximately 190 to 200 ft long, through which moves a 6-ft-wide traveling grate loaded with pellets, plus auxiliary equipment for ball-making or pelletizing. Ball-making consists of continuously feeding concentrate into large drums which rotate at a predetermined speed. The balls formed in the drums are approximately $^3/_8$ to $^5/_2$ in. in size and contain about 10 per cent moisture and the required amount of pulverized anthracite coal for burning purposes.

These balls are fed onto the furnace grate by means of a mechanical oscillating feeder at the rate of about 50 to 55 tons per hour. The first step in the heat-hardening operation is the drying and preheating of the pellets, followed by burning which makes them hard.

The pellets are ignited at a temperature range of 2300 to 2400 F, and complete burning is accomplished by the propagation of the heat down through the 15-in-deep bed at a burning rate of approximately 1 rpm. This burning causes a molecular change to occur in the concentrate which in turn generates heat of its own, amounting to approximately 40 per cent. Large volumes of air are required to accomplish this operation.

Burning of the pellets takes place within approximately a 30-ft section of the machine, the grate portion of which moves forward at the rate of about 30 rpm. The machine is so designed that the heat which is retained in the burned pellets is recovered and utilized for drying and igniting the "green" pellets at the feed end of the machine.

In order to facilitate handling, the burned pellets are finally cooled on the grate by again pulling large volumes of air down through the bed—cold air this time. The pellets are then discharged from the machine and are screened to remove the small undesirable particles prior to loading into railroad cars for shipment by rail and lake carriers to blast furnaces.

Metals and Alloys

Zirconium Production

PRODUCTION of ductile zirconium by a less costly method will receive increasing emphasis from the Bureau of Mines, according to the Department of Interior.

Nearly as strong as steel, but a little lighter, metallic zirconium is highly corrosion-resistant and has a high melting point (3350 F). Also, it does not absorb, and thus waste, neutrons needed to sustain a chain reaction. These properties qualify it for use in building in hot atomic ovens. It was a vital material in the construction of the U. S. S. *Nautilus*, the first atomic-powered submarine.

In 1945 Bureau metallurgists began the task of adapting the Kroll magnesium-reduction process, already successfully used in making ductile titanium metal, to production of metallic zirconium. The Atomic Energy Commission became interested in zirconium as a construction material in 1948 and, from contact with the Bureau's Northwest Electrodevelopment Laboratory at Albany, Ore., found a pilot plant capable of producing 60 lb of sponge a week already operating. In co-operation with the AEC and the Navy's Bureau of Ships, facilities at Albany since have been expanded to the point where more than 280,000 lb of sponge metal was produced in 1953.

In addition, private industry also is using the Kroll process to produce the metal. And when it can supply defense requirements the Bureau will be free to concentrate more on basic research.

Before the Bureau began development of the Kroll process, zirconium was produced commercially in the United States only by an expensive iodide process and

sold for more than $70 a pound. Continuous development and improvement of the Kroll method by the Bureau has made it possible to make zirconium sponge that sells for about $10 a pound.

Iodide-process metal is still being produced, however. It is used in making tiny "metallic sponges" that soak up harmful gases in vacuum tubes for radio, television, and radar, in metal plates used by surgeons to cover delicate brain tissues, and in other highly specialized applications.

For atomic-energy purposes, zirconium must be free of hafnium, a metallic element that usually is closely associated with zircon and baddeleyite. Seeking a means of producing hafnium-free zirconium, the Bureau developed a method by which hafnium also can be obtained as a ductile metal, and for the first time made it available in amounts large enough for experimental applications. Later, it was discovered that hafnium also is a useful metal in the atomic-energy field. The Bureau now produces more than 6000 lb a year of this metal in conjunction with its zirconium operations.

Bureau metallurgists also have developed a consumable-electrode arc-melting process which industry is using to melt the zirconium sponge produced at Albany into ingots for defense.

At present, Kroll-process zirconium is not in short supply—it has been available for industrial use from a leading producer for the past two years—but its high cost prohibits widespread commercial use. Industry's biggest problem is to find means of producing large quantities of the metal at prices low enough to encourage its utilization. Having already lowered production costs tremendously, the Bureau hopes to reduce them still further, either by improving the present batch process or by developing a continuous one.

Lightweight Titanium Alloy

A lightweight titanium alloy considered suitable as a replacement for steel in military weapons has been developed for the Ordnance Corps by Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.

Use of the alloy in the manufacture of heavy weapons and tanks would greatly increase their mobility, according to Dr. Donald J. McPherson, nonferrous metallurgy supervisor at the Foundation.

The alloy was developed during the course of a program being sponsored at the Foundation by the Watertown Arsenal Laboratory, Watertown, Mass. The laboratory administers much titanium research for the Army.

Dr. McPherson explained that plates of the new alloy fabricated by ARF engineers were heat-treated and tested at Watertown and found to be "very promising."

Col. B. S. Mesick, commanding officer of the Arsenal and co-ordinator of the Army titanium program, revealed that the titanium alloy is 40 per cent lighter in weight than high-strength steel.

The Watertown tests also show that the alloy is highly corrosion-resistant and has properties which compare favorably with those of steel used in manufacturing weapons.

Ordnance stressed that further tests must be made to assure that the alloy is as good as first tests indicate. But the alloy is considered by Ordnance as a potential substitute for steel in many ordnance components.

Another property determined by the Watertown tests is that the alloy shows tensile strengths up to 192,000 psi. This is approximately 42,000 psi stronger than any commercial alloy of titanium now being produced.

Nonheat-treatable Aluminum Alloy

A new high-strength nonheat-treatable aluminum alloy, K186, especially designed for weldability and adaptability to structural applications, has been announced by Kaiser Aluminum and Chemical Corporation, Oakland, Calif.

Typical applications recommended by Kaiser include unfired pressure vessels, structural towers, welded boat hulls, rocket-motor tubing, guided-missile containers, aircraft-carrier elevators, trusses and girders, truck and trailer frames, tanks, pipe lines, and scaffolding.

Available in sheet and plate form, in a full range of tempers, Kaiser has an extrusion-development program currently under way to extend the range of applications.

Test inert-gas shielded-arc welds made on 0.250 gage K186 hot-rolled plate illustrate the excellent welding characteristics of the new metal. The plates were welded transversely with 56S filler wire using a square butt joint and two passes.

The average results of 10 tensile tests made in the longitudinal (rolling) direction of the plate showed joint efficiency with weld beads on was 89 per cent and with the beads machined flush, 79 per cent.

Longitudinal ultimate tensile strength of the parent metal was 44,700 psi. With beads on ultimate strength was 39,900 psi and with beads machined flush, 35,500 psi.

Nominal composition of K186 is 4.0 per cent magnesium, 0.45 per cent manganese, and 0.10 per cent chromium.

Typical mechanical properties of K186 in various tempers are:

	Temper			
	O	H32	H34	H112
Tensile strength, psi	38,000	42,000	47,000	39,000
Yield strength, psi	17,000	30,000	37,000	19,000
Elongation, per cent in 2 in.	22	12	10	14

Minimum mechanical properties for plate in H112 temper are 34,000 psi, tensile strength; 14,000 psi, yield strength; and elongation of 8 per cent.

In the annealed condition, K186 has a tensile strength approximately 30 per cent greater than 52S, which is of marked significance in welding applications.

Formability of K186 has been determined as good through a series of investigations including hammered, guided, impact, and elevated temperature-bend tests. Cold-forming in H112 temper is good. Excellent formability is obtained when the material is heated to 400 F.

Accelerated and long-term corrosion tests conducted both in the laboratory and natural marine environments have evidenced excellent corrosion-resistance characteristics for K186. Additional tests conducted to determine the alloy's susceptibility to stress corrosion indicated no problem in this regard.

Standard finishing procedures may be used with K186 and corrosion-resistant anodized finishes can be applied.

Waspaloy

The development of a nickel-based, heat-resisting alloy for jet-engine turbine blades was announced recently by Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Conn.

Called "Waspaloy" after P&WA's series of Wasp engines, the alloy has boosted the power rating of one of the company's leading jet engines, the centrifugal-flow J-48 turbojet which now has a basic thrust rating of 7250 lb.

Used in turbine blades for the J-48, Waspaloy's superior heat-resisting properties permit the engine to operate at higher turbine temperatures for longer periods of time than was previously possible.

P&WA's J-48 engines power the Navy's Grumman F9F-5 Panthers and Grumman F9F-6 Cougars, and the Air Force's Lockheed F-94C Starfires. The Starfires have J-48 engines with afterburners for added thrust.

The development of Waspaloy was started in 1949 when P&WA engineers sought a metal that would withstand the severe stresses encountered at temperatures of about 1500 F. When revolving at full speed, each turbine blade is subject to an outpull equal to about 25,000 times its own weight. This is roughly equivalent to having eight average-sized automobiles hanging from the tip of each blade.

The alloy has a base of more than 50 per cent nickel to which varying amounts of chromium, cobalt, molybdenum, titanium, and aluminum are added. Most of these materials are readily available in North America.

Steel Industry

For the first time since 1951, the large-scale expansion and improvement programs of iron and steel companies have been measured in terms of plants and capacities for making finished-steel products as well as in terms of ingot capacity, according to *Steel Facts*, August, 1954. Finished steel is the steel used for automobiles, refrigerators, farm equipment, railroad cars, pipe lines, ships, and thousands of other items, some as small and short-lived as common pins.

Industry Larger Than Ever

The steel industry, with its many products and many plants, is larger and more diversified than ever before, according to data recently assembled by the American Iron and Steel Institute for its new "Directory of Iron and Steel Works of the United States and Canada."

The industry in the United States consists of 255 companies. They have 430 plants making or finishing iron or steel in 270 communities in 31 states. The total area covered by the plants is estimated to be more than 80 square miles. This does not include the raw-material properties or other facilities not directly involved in production. About 15 years ago the industry consisted of only 360 plants in 27 states.

In the short space of three years, some of the industry's finished-steel-product capacities have been increased up to 40 per cent. The annual capacity for making hot-rolled products is now over 96.6 million tons a year, against 84 million tons in 1951.

More Steel for Consumers

The increases have been particularly large in the products that are widely used for consumer goods. These products include sheet-and-strip steel and tin plate. At the same time, the capacities for most other finished steel products also have been increased. The enlarged and improved steel-rolling facilities have been kept extremely flexible. One rolling mill may produce several different products.

The increases in the three-year interval include: Hot-rolled sheet-and-strip steel and coiled strip for tin plate, up 26 per cent; cold-rolled sheet-and-strip capacity, up 42 per cent; tin and terneplate capacity, up 12 per cent; hot-rolled bars, other than concrete bars, up 18 per cent; cold-finished bars, up 27 per cent; pipe and tubing capacity, up 14 per cent; wire-rod capacity, up 10 per cent.

Many other changes have taken place in the industry since 1951.

The steel industry includes 96 companies which make hot-rolled products. These companies operate in 28 states. Many other companies of the steel industry do not have hot-rolling facilities but purchase such material and manufacture it into wire, pipe, cold-rolled sheets, strip, or other products.

Pennsylvania, Ohio, Indiana, and Illinois are the leading states in hot-rolled capacity. Among the states that have advanced in rank in the past three years are New York, now in sixth place, and Texas, now in eleventh place. During the three-year interval Pennsylvania had the largest increase, followed by Ohio and Indiana.

Nebraska, which was not on the steel map a few years ago, has acquired steel-finishing capacity without becoming an ingot maker or a hot-rolled steel producer, the same as Florida and Iowa.

Among other changes: Texas is now the leading state in capacity for making electric weld pipe and Pennsylvania has taken the lead from Ohio in butt-weld-pipe capacity.

More Companies Make Steel

Eighty-five companies make steel now against 76 three years ago. Their plants are in 120 communities, in 27 states. The companies have 1223 steelmaking furnaces, or 22 fewer than in 1951. However, the total annual steelmaking capacity has been sharply increased. Over 124 million tons of raw steel can be made in a year now, against 104 million tons three years ago.

Pennsylvania, Ohio, Indiana, and Illinois are the largest producers of raw steel. Ohio had the largest increase in the past three years, followed closely by Pennsylvania. Among the steelmaking states that have advanced in rank in the past three years are Michigan, now in fifth place, Utah, now in eleventh place, and Texas in thirteenth place.

Blast Furnaces in 74 Towns

The industry has 260 blast furnaces capable of producing 82 million tons of pig iron and ferroalloys a year. This compares with 250 furnaces and 72.5 million-tons capacity three years ago. The blast-furnace plants are located in 74 communities in 18 states.

To supply the blast furnaces with coke, the chief fuel used in the furnaces, the industry operates nearly 14,000 by-product coke ovens capable of making over 73 million tons of coke annually.

Three-Electrode Atomic Battery

An atomic battery in which a control element has been added was announced recently by Philip E. Ohmart, president and director of research of the Ohmart Corporation, Cincinnati, Ohio, at a meeting in the Engineer-

Fig. 4 Philip E. Ohmart demonstrates atomic battery in which a third electrode has been added. Addition of this element makes it possible to vary the output current of the battery. It is powered by small quantities of strontium-90, a long-life radioactive isotope.

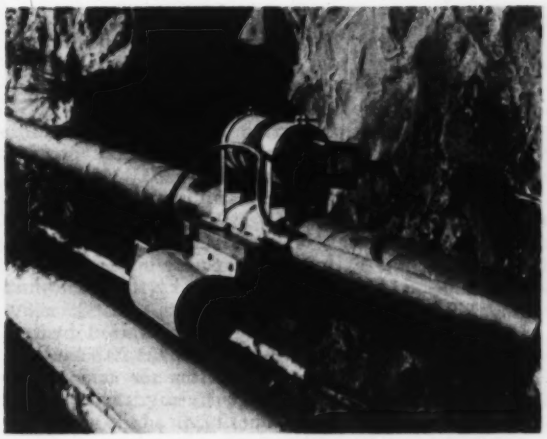


Fig. 5 A close-up of a density-gage installation for the measurement of the density of materials flowing in pipe lines. The adjustable atomic battery is shown at the upper left. The Ohmart cell used for the measurement of the radiation field intensity is mounted on the right.

ing Societies Building, New York, N. Y. The addition of this element, a third electrode, makes it possible to vary the output current of the atomic battery and foretells an era of self-powered atomic amplifiers, he said. Mr. Ohmart also showed several other heretofor unannounced new products. These included a commercial form of their atomic battery, a test instrument which employs an atomic battery as its only source of electric power, and an industrial gage in which atomic batteries are used to furnish constant currents for reference purposes.

This three-electrode development, which to date has been applied only to gas-filled batteries, also can be applied to semiconductor-type atomic batteries, with an increase in efficiency.

The three-electrode battery is powered by small quantities of a long-life radioactive isotope, strontium-90, which is a waste product of atomic reactors of a type operating at Oak Ridge, Argonne National Laboratories, Hanford, Wash., and Brookhaven, N. Y. Although the price of such material is now high, it is anticipated that as more and more peacetime applications of atomic energy, such as the three-electrode battery and the atomic battery, are found, costs will be tremendously reduced.

One of the first uses to which this device has been put is in a small, compact instrument used for the measurement of the total of varying quantities. Continued work in increasing the amplification of these units has been rapid during recent months and is expected to continue. Results to date indicate the possibilities of making small-sized, self-contained, self-powered, amplifying units, which will take the place of both batteries and vacuum tubes in electronic equipment. When these amplifiers have been made to be more powerful, they will operate an electronic apparatus without attention or replacement for many years.

Mr. Ohmart also told of a variable-current atomic battery which is used as a source of constant current in industrial instruments. This new atomic battery, which it is said will be available to the commercial market this fall, is only $1^1/_8$ in. in diam. and 3 in. long. It has been designed mainly to provide a source of voltage and current that will remain constant for many years. It is anticipated that these units will find many applications in equipment such as jet aircraft and rockets, where they will provide uniform current under extreme conditions of temperature and vibration in order to stabilize control and signal equipment.

Another device described at the meeting was the Ohmart signal generator, an instrument built and designed around an atomic battery. This uses the power of an atomic battery to provide signals for testing radio, radar, and other electronic equipment. Devices of this nature are of particular significance because no electric power other than that generated by the atomic battery is required in their operation. Also, they can withstand extremes of temperature and rough handling which make other types of batteries inoperative.

Besides providing test signals, atomic batteries are also being used as current sources in industrial instruments, many of which are now in use throughout the United States in controlling manufacturing processes in industries. In the past two years, Mr. Ohmart said, more than 200 installations using atomic batteries in their operation have been installed in more than 70 industrial plants. They are of use in the manufacture of such diverse products as plastics, foodstuffs, asbestos pipe, glass, cement, coke, instant coffee, etc.

Electric-Power Production

Electric utilities in the United States produced 38,901,056,000 kwhr of electric energy during June, the highest June production total on record and an increase of 5.2 per cent over the 36,977,439,000 kwhr generated in the similar month a year earlier, the Federal Power Commission reported in its "Production of Electric Energy in the United States" series. The June total was 3.9 per cent above the 37,428,981,000 kwhr produced during the preceding month.

Water-power plants produced 9,585,992,000 kwhr in June, an increase of 5.3 per cent above June of 1953. Water-power output accounted for 24.64 per cent of total generation in June, 1954, practically unchanged from

24.63 per cent in June, 1953. Production by fuel-burning plants in June was 5.2 per cent above that for June, 1953.

For the year ending June 30, 1954, electric-utility production totaled a record of 453,520,531,000 kwhr or 7.6 per cent more than production during the year ending June, 1953. It exceeded by 0.4 per cent the previous maximum set during the period ending May 31, 1954.

Reports received by the Commission indicate that there was a net increase of 1,495,360 kw in the installed capacity of generating plants in utility service during June. As of June 30 this year, capacity indicated a 1954 first-half net addition of 10,244,403 kw from the final 91,502,249-kw total in service December 31, 1953.

Industrial production, including generation by railway and railroad plants, was 6,074,223,000 kwhr in June, an increase of 7.6 per cent from the same month last year. Total industrial generating capacity was 16,249,816 kw at the end of June, 1954.

Combined utility and industrial production during June was 44,975,279,000 kwhr, 4.8 per cent above the same month last year, and for the year, ending June 30, 1954, was 7.4 per cent above the same period a year earlier. Utility and industrial generating capacity totaled 111,558,789 kw on June 30, 1954.

The report is compiled from data filed with the Commission by electric utilities and industrial plants of the United States. The report may be obtained from the Federal Power Commission, Washington 25, D. C., for ten cents.

Diesel Fuel-Injection System

A NEW simplified diesel-fuel system, making diesel fuel injection as simple if not simpler than gasoline-engine carburetion and ignition systems, has been developed by Cummins Engine Company, Inc., Columbus, Ind.

Designated the Cummins PT Fuel-Injection System, the system completely eliminates fuel-rack adjustments, high and low-pressure check valves, high-pressure fuel lines, and the necessity for timing the fuel pump to the engine. Now standard equipment on all models of Cummins diesel engines, the system can be applied to all Cummins diesels built since 1932, thus permitting older engines to be completely modernized.

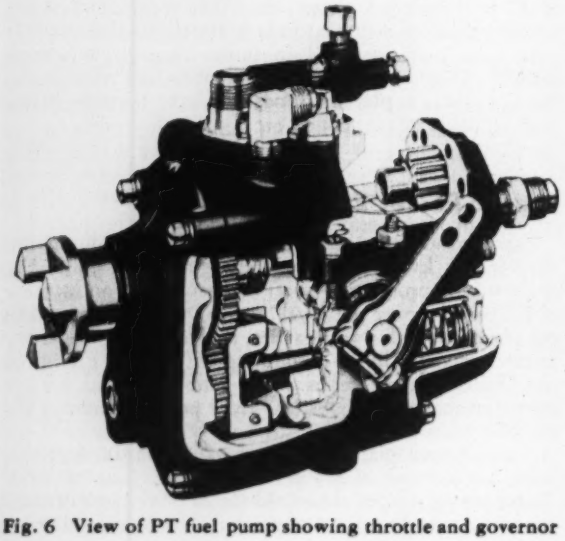


Fig. 6 View of PT fuel pump showing throttle and governor

The system uses one of the simplest types of fluid-metering devices known, namely, a fixed orifice with a variable fuel-oil pressure behind it. The metering orifice is now a part of the fuel injector located in the cylinder head, thus adding the metering function to the injector. Although the injector now serves the dual purpose of metering and injecting the fuel, the construction and servicing of the injectors have been greatly simplified.

With the metering function now in the injector, the once-complicated fuel pump has become simply a source of fuel pressure with a pressure regulator, throttle control, governor control, and "start-stop" control serving to restrict the flow of fuel and so varying the fuel pressure at the metering orifice.

Injector plungers are operated from lobes on the main engine camshaft and control the timing of the engine, as in the past. However, since the timing is controlled by the engine camshaft, the new system need not be timed to the engine.

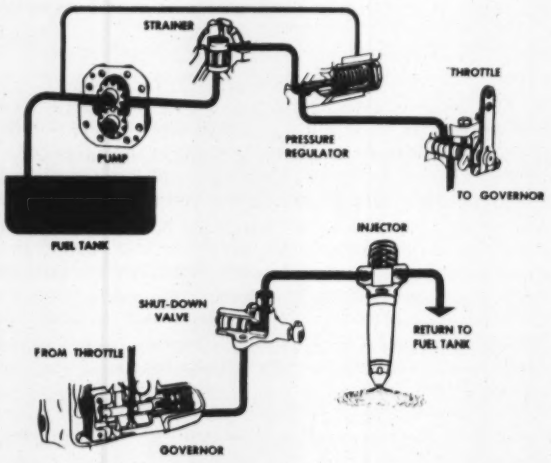


Fig. 7 PT fuel-flow diagram shows pressure regulator, throttle, and governor in full horsepower operating positions

The system has only 13 per cent of the bulk of the Cummins distributor-type fuel pump introduced in 1932. Weight of the PT Fuel System is only 13 lb as compared to 104 lb for the earlier pump. The total number of parts in the PT Fuel System has been reduced to 182 as compared to 415 in the former disk-type pump.

Briefly, the fuel system operates as follows:

A gear pump picks up the fuel from the fuel tank, creating the basic fuel pressure for the system. This pressure is then controlled by a pressure regulator which is designed to control the maximum pressure in the system and give the proper torque and horsepower characteristics.

The fuel pressure from this regulator is controlled by a simple throttle-control valve, a simple governor-control valve, and an "on-and-off" shutdown valve. From this point the fuel flows from the fuel pump to a common manifold leading to each of the injectors located in the engine cylinder head. The pressure from the fuel pump

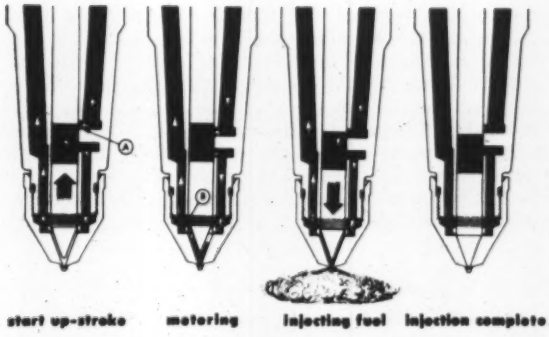


Fig. 8 Fuel metering injection cycle of PT injector. *Start Up-Stroke.* As plunger moves up, fuel supply hole is uncovered, allowing fuel to circulate through the injector and out of drain at left. About four fifths of the fuel delivered to the injector is returned to the fuel tank. *Metering.* Now plunger has uncovered metering orifice, *at left*, allowing fuel to enter injector cup. The length of time this opening is uncovered and the pressure supplied by the fuel pump determines the quantity of fuel injected. *Injecting Fuel.* As plunger moves down it "pushes" fuel through holes in the tip of the injector cup and into the cylinder as an exceptionally fine spray, insuring thorough mixing with the air and complete burning of entire fuel charge. *Injection Complete.* Following injection the plunger remains seated until it is time to repeat cycle. Action of the injector plunger is controlled directly by engine camshaft assuring injection of the fuel charge at the most effective time.

is applied to the metering orifice in the injectors and, depending upon the pressure in the manifold, more or less fuel is metered through the orifice into the injector cup in the top of the engine combustion chamber. At the proper time for firing, the injector plunger is forced down by the action of a cam on the main engine camshaft, forcing the metered fuel through the spray holes in the injector cup.

Since all injectors are connected to the common manifold, all receive the same pressure and equal charges of fuel are injected into each of the engine's cylinders, assuring that each cylinder develops equal power without the necessity for individual adjustment of each injector.

In excess of 21 million miles of successful fuel testing were logged on more than 400 "field-test" Cummins PT Fuel Systems installed in on-highway trucks, off-highway haulage equipment, shovels, cranes, locomotives, and marine engines. Operators report better acceleration, more positive throttle control, improved fuel mileage, and lower maintenance cost.

Service life of the diesel fuel system also has been greatly extended. In addition, the simplicity of the system makes it extremely simple to maintain and "trouble-shoot."

Looking into the future, Cummins Officials report that the PT Fuel System, already successfully used on experimental engines operating at rotative speeds in excess of 4000 rpm, removes the previous limitations to higher diesel-engine rotative speeds imposed by the fuel system. Higher rotative speeds will make possible more compact, lighter-weight diesel engines in the future.

The new Cummins PT Diesel Fuel system was the subject of a paper presented by J. W. Rowell and C. R. Call of Cummins, before the recent West Coast Meeting of the Society of Automotive Engineers, in Los Angeles, Calif.

Magnetic Fatigue Tester

By determining the load that can be applied repeatedly to steel samples without causing failure, detailed information on how to build and fabricate greater safety into steel conveyances and structures will be available from the new Research Center now under construction by U. S. Steel Corporation near Pittsburgh, Pa.

One of the machines now being used for such research at U. S. Steel's Research and Development Laboratory in the Oakland District of Pittsburgh is a magnetic fatigue tester. Samples of steel from 24 to 36 in. in length and up to 2 in. thick and 5 in. wide can be subjected to controlled vibrations at the natural frequency of the test piece.

The machine consists of two rubber-padded supports upon which the test piece is placed, an electromagnet located at each end of the tester, pickup coils located at the center of the sample, a power unit with controls, a stroboscopic light, and a microcomparator to measure vibration amplitudes.

A piece of steel, which must be long enough to extend over the two end magnets, is placed on the rubber-padded supports and the end magnets are positioned under the ends of the sample. An alternating current is then supplied to the end magnets to set the steel vibrating, much after the fashion of a tuning fork.

Each experimental section has a natural frequency at which it will vibrate, the natural frequency depending on the dimensions of the piece. The center pickup coils translate the motion into electrical impulses which feed back to the power unit at the natural frequency of the sample. These impulses control the pulsations of electricity from the power unit to the end magnets so they match the frequency of the specimen and keep it vibrating.

The amplitude of the sample's vibrations depends on the intensity of the current supplied to the end magnets.

When a crack develops in the test specimen, its natural vibrational frequency changes. This change upsets the rhythm of impulses from the pickup coils to the power unit and the machine automatically stops.

By use of the microcomparator, the research scientist

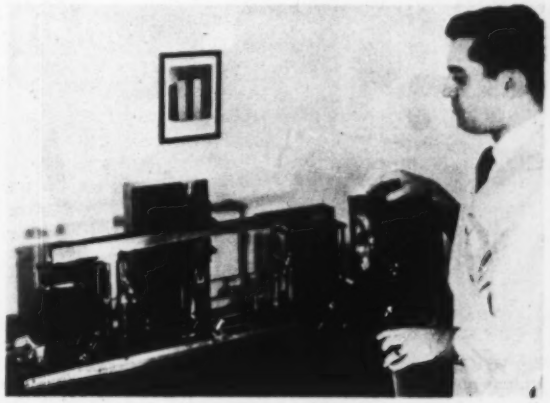


Fig. 9 Magnetic fatigue-testing machine is shown here subjecting a steel sample to controlled vibration to determine its resistance to fatigue failure. Vibrating at about 100 cps, the ends of the sample appear blurred in the photograph. The laboratory technician is about to use a stroboscopic light. In this light the sample appears to be bending slowly and its surfaces can be examined for small cracks.

easily can measure the amplitude of the vibration or the amount of bending.

The stroboscopic light is used to establish the location of very small fatigue cracks. This is done by adjusting the light from the stroboscope to a frequency slightly higher or slightly lower than that of the vibrating sample. In this light the test piece appears to be bending very slowly and its surfaces can be examined carefully for small cracks.

A test sample about $^3/_4$ in. thick × 3 in. wide × 30 in. long will vibrate at about 100 cps. Middle C in the diatonic scale is 256 cps and C below middle C is 130 cps or almost 8000 per min. Past experience and innumerable tests have proved that if a specimen can endure 10,000,000 cycles at a certain amplitude without failure, it will withstand an infinite number of vibrations at that amplitude.

If a structural component is desired with a minimum of 20,000 psi endurance limit, the research scientist quickly can determine on the magnetic fatigue tester what steels will meet the requirement. Resistance to fatigue failure is important to insure a safe design.

Through the application of the results from such tests on steels for aircraft, bridges, and other applications in which cyclic loading occurs, engineers can design lighter and safer structures. The machine also makes possible the determination of the fatigue limits of steels with various surface finishes and with welds, rivets, and other fastenings.

Electronic Thickness Gages

THREE types of instruments for measuring the thickness of electrodeposited coatings have been developed recently by the National Bureau of Standards. While all three instruments depend upon the difference in electrical conductivity between the plating and the basis metal, each makes use of different methods for sensing specimen resistance. Two of the instruments, the "Dermitron" and the Phase-Angle Thickness Meter, utilize electromagnetic coupling to the specimen, making use of the reflected field from eddy currents induced in the specimen. A third, a wave-guide inspection tool, employs direct conductivity measurement with point electrode. All three devices permit simple nondestructive determination of plating thickness or of sample thickness for homogeneous metals. When appropriately calibrated, they can be used for measurement of magnetic as well as nonmagnetic materials.

The Dermitron senses the reflected flux in a single coil which is excited with high-frequency current when it is in close proximity to the specimen. The probe coil is very small and is designed to be held in physical contact with the sample. Its miniature size makes it possible to measure plating thicknesses of small specimens and sharply curved surfaces. When the instrument is calibrated for the specific use, measurements can be made on combinations of metals regardless of whether either coating or basis metal is magnetic or nonmagnetic. The instrument is portable and direct-reading and should provide a convenient means for routine testing of a manufacturer's output.

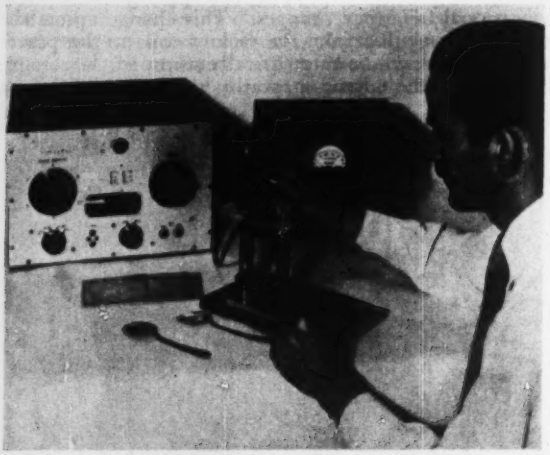


Fig. 10 Dermitron electronic thickness gage provides a convenient means for measuring the thickness of plated coatings on silverware. In making a measurement, the circuit is first adjusted so that the meter (*center background*) reads zero when the probe is placed on a specimen of the bare basis metal. A reading is then taken with the probe placed on the test surface (*as in the photograph*), and the thickness of the coating is obtained from a calibration curve. The device can be used for all types of metallic coatings which differ from the basis metal in electrical conductivity.

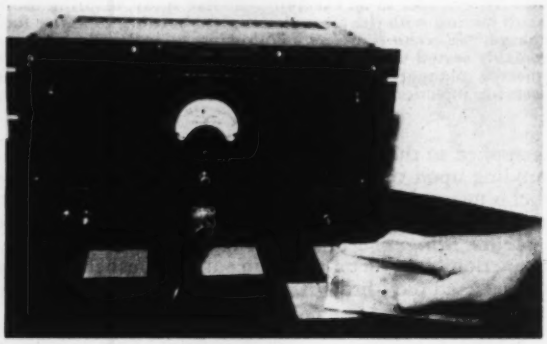


Fig. 11 Phase-angle thickness meter features insensitivity to variations in the probe-to-sample spacing in determining the thickness of silver plating on a nonmagnetic basis metal

The Phase-Angle Thickness Meter relies on the measurement of reflected electromagnetic field with a separate pickup coil. For this it requires a somewhat more complicated electronic circuit. Through a bucking-transformer arrangement a voltage is derived whose phase shift is a direct function of the specimen conductivity. Measurement of phase change thus provides a means to indicate plating thickness. Originally developed for the rapid continuous measurement of the thickness of silver plating on such large areas as stainless-steel waveguides, it offers insensitivity to variation in probe-to-sample spacing. With suitable calibration, the instrument also can be used on magnetic materials, but probe-to-sample spacing must be controlled.

The Waveguide Plating Quantity Indicator was developed to permit measurement on both nonmagnetic and magnetic materials without change of calibration. The specific application was for use on waveguides having an intermediate layer of nickel of unknown thickness between the silver and stainless steel. In the

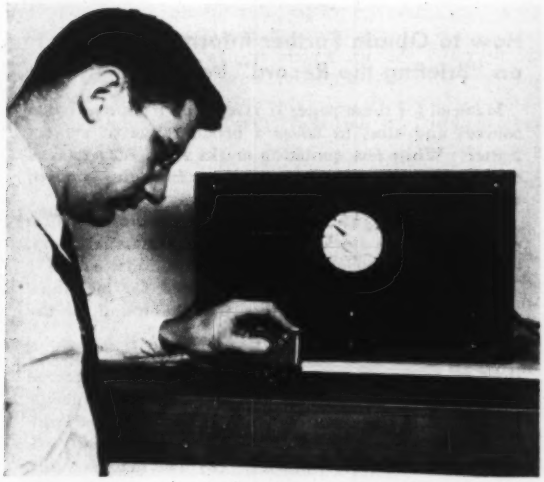


Fig. 12 Waveguide plating indicator conveniently measures from the outside the quantity of silver plating on the inside of an L-band waveguide. The instrument uses conductance measuring techniques to determine the thickness of the internal plating. The indicator is simple to use; the operator need only place the probe on the waveguide and read the meter.

instrument a direct current is passed through the specimen, and the voltage drop across a known distance is measured. While the silver plating is on the inside of the waveguide, its effect on the d-c conductivity measurement is the same as for outside plating. Thus the probe electrodes can be arranged to make contact on the outer surface, simplifying the measurement procedure.

Technical Institute Survey

THE results of the Annual Survey of Technical Institutes for 1953-1954, prepared by Leo J. Smith, Dean of Instruction, Rochester Institute of Technology, appears in *Technical Education News*, August, 1954. According to the survey, all institutions were asked to report enrollments as of Jan. 2, 1954. The present survey includes enrollments for 62 schools in the United States, five less than the number reporting a year ago. In addition, the enrollments from six Canadian schools are included.

The report reveals that in the 62 institutions reporting 21,527 students were enrolled. This represents an increase of 15.3 per cent as compared with the 18,840 reported one year ago. In addition, 29,410 evening and part-time students were reported this year, a decrease of 13.4 per cent over the 33,897 reported last year. The grand total of 50,937 is a decrease of 3.8 per cent as compared with the 52,737 reported in 1952-1953. Enrollment in the Canadian schools is not included in these comparisons.

Federal Schools

The report notes that the Federal Schools have been hard hit by the economy drive of the present national administration. Both the U. S. Maritime Service Training Stations and the U. S. Maritime Service Institute reported that the date of deactivation had already been set, or was impending. Captain Spring, former director of the Maritime Service Institute, reported that 1373 certificates of completion were awarded for correspondence courses during the past year.

State and Municipal Institutes

An enrollment of 9903 regular day students in 19 institutes reporting was indicated as compared with 9239 in 20 such schools last year. The evening and part-time enrollment this year is 7913, as compared to 8902 one year ago.

The five New York State Institutes of Applied Arts and Sciences, which were established on an experimental basis in 1946, and operated tuition-free by the state, have now been transferred to the communities in which they are located and are operating under a new community college law. This provides that the state pays approximately one third of the cost; the local community one third; and the student one third.

The new names of the schools are: Broome County Technical Institute, Binghamton, N. Y.; Erie County Technical Institute, Buffalo, N. Y.; New York City Community College of Applied Arts and Sciences, Brooklyn, N. Y.; Mohawk Valley Technical Institute, Utica, N. Y.; and Westchester Community College, White Plains, N. Y.

A new institute has also been established in Troy, N. Y., and is named the Hudson Valley Technical Institute. This is an outgrowth of the Troy Vocational School which was established at the end of World War II to train veterans.

Privately Endowed Technical Institutes

Twelve private institutes reported an enrollment of 2780 regular day students as compared with 2506 reported by ten schools last year. The evening and part-time enrollment of 7798 this year compares with 8983 reported one year ago.

The Rochester Institute of Technology now offers programs leading to the Bachelor of Science degree in the Chemistry, Electrical, Mechanical, Printing, Photography, and Art Departments, and the School for American Craftsmen. These programs will be built on top of the present programs leading to associate degrees, which have been offered for many years.

Extension Divisions of Colleges and Universities

A regular day enrollment of 2993 in the extension divisions of 11 colleges and universities was reported as compared with 2045 last year. The evening and part-time enrollment this year of 9774 compares with 10,885 reported last year.

Thomas Rung of The Pennsylvania State University, reports that their curriculums in electrical technology and in drafting and design technology have been converted from one-year to two-year programs.

Proprietary Technical Institutes

A regular day enrollment of 5800 in the 19 schools reporting compares with 5038 reported by 20 schools one year ago. The evening and part-time enrollment this year is 3421 as compared with 3119 last year.

YMCA Schools

A day enrollentm of 51 students for the two YMCA

schools reporting this year was listed. In addition, 504 evening and part-time students were reported.

Canadian Schools

The day enrollment for the six Canadian schools reporting is 2183 which compares with an enrollment of 2542 reported by seven schools one year ago. The Ryerson Institute of Technology reports an evening enrollment of 4630, which is an increase of more than 1000 students over last year.

Summary and Conclusions

As a result of this survey the following conclusions may be drawn:

1 The day enrollments have increased significantly this year (15.3 per cent) although the evening and part-time enrollments are down (13.4 per cent). Largely as a result of the lower evening and part-time enrollment the total enrollment is down slightly (3.8 per cent). It should be pointed out, however, that only 62 schools reported this year as compared with 67 one year ago.

2 Since these annual surveys were first initiated both the state maritime academies and the Federal schools have faded from the picture. The former have all become four-year, degree-granting institutions, while the latter have been discontinued by the Federal government.

3 The State of New York has turned the five Institutes of Applied Arts and Sciences over to the local communities under a new community-college law. Even though the latter institutions are now charging from $200 to $260 per year for tuition, this does not appear to have seriously affected enrollment in these schools.

4 The New York City Community College of Applied Arts and Sciences reported the largest day enrollment with 2542 students. The Ryerson Institute of Technology has the largest total enrollment with 6136 students. Rochester Institute of Technology had 4277; Farmingdale, 4149; Brooklyn, 4141; and the technical institutes of The Pennsylvania State University, 4089.

Ceramic Coatings

RADICALLY new and flexible ceramic coatings can now be applied to a wide variety of materials as the result of a process developed at Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill.

The new coatings differ from conventional coatings, such as porcelain enamel, in that they are not brittle and can be applied to almost any clean solid surface at a few hundred degrees Fahrenheit.

Called "solution ceramics" because they are applied from chemical solutions, the new coatings do not contain any adhesive or binding agent.

Unusual features of the coatings are as follows:

1 Application is easy, requiring neither expensive equipment nor protected heating.

2 The temperature required by the coating process is far lower than that required for porcelain enamel.

3 The thickness of coatings can be controlled accurately. While films as thick as 0.01 in. can be deposited, some coatings only a few millionths of an inch thick have been made.

4 Solution-ceramic coatings are highly resistant to heat, and the more refractory ones can be used to protect a metal, for instance, against molten metal or slag.

5 The coatings are less hard than ordinary ceramic materials and can be scratched with a knife blade. This allows sheet metals coated with solution ceramics to be stamped after coating.

6 Most solution ceramics are so adherent to the surface of the underlying material that other coatings can be anchored to them.

7 Like most ceramic materials, solution-ceramic coatings are themselves resistant to chemical attack, even at high temperatures. This is especially evident when the ceramic itself is refractory and stable.

The process will be made available to industrial firms through license agreements which will allow them to use Foundation patents now applied for in solution ceramics.

Solution ceramics, the Foundation stressed, should be judged on their individual merits and cannot be compared with conventional coatings, such as porcelain enamel. They should be regarded as new materials.

There are many widely different solution ceramics, it was explained. The coatings studied more intensively at Armour are refractory metal oxides—zirconia, chromia, titania, ceria, magnesia, and similar materials.

However, the solution-ceramics process is not limited to such compounds. Certain phosphates, silicates, fluosilicates, oxyhalides, and even metals, can be deposited in this way, and two or more of the materials can be codeposited or applied in separate layers.

Potential applications seen for the process range from foundry use through others in ceramics, as follows:

1 Foundry applications include coatings for molds, cores, chills, inserts, stoppers, runners, crucibles or holding ladles, and die-casting reservoirs and metal pumps, facing coatings, and upgrading molding sands.

2 The process might be used to provide high-tempera-

How to Obtain Further Information on "Briefing the Record" Items

Material for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

This material is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources; i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

ture coating for resistor wire or tape, condensers, wire-bound conductors, and thermocouples.

3 Ceramics applications might include colorant for pottery, tile, and glass, and coating method for applying conductive, photoemissive, catalytic, or decorative coatings to glass, ceramics, cermets, which are composites of ceramics and metals.

Giant Asbestos Mill

WHAT is claimed to be the largest asbestos mill in the world was opened on September 30, at Asbestos, Quebec, Can., by Johns-Manville Corporation. It will mill more than one third of the free world's supply of asbestos fiber most of which finds its way to the United States to be manufactured into scores of essential products for home, farm, industry, and national defense.

Anticipating the trend toward greater mechanization in the asbestos industry, the new Johns-Manville mill will replace several existing mills and provide more modern facilities with increased production capacity at lower operating costs.

The new mill is the largest project of the Quebec asbestos-mining industry which has embarked upon a $70,000,000 program of expansion and development of new mines, mills, and machinery.

The new mill occupies a 14-story, steel-and-concrete building that has 22½ acres of floor space. When in full production early in 1956 it will provide additional capacity of 60 carloads aggregating 2500 tons. Adjacent to the famous J-M Jeffrey Mine, long known as the largest asbestos mine in the world, the new mill will draw on ore reserves for more than 100 years of operation at the present rate of production.

Equipped with the most modern lighting, safety devices, and dust-control equipment, the mill is expected to provide the safest and healthiest working conditions of any fiber mill in Canada or the United States, company officials say.

There are 4000 separate dust enclosures, utilizing four miles of piping and 12 miles of control wiring in the dust-control system. It takes 30 acres of cloth to provide bags used in filtering dust as the ore is milled. When in full operation, the new mill will have air-handling equipment capable of purifying 2,500,000 cfm of air.

There are 5000 separate safety guards on the milling equipment and more than 4600 fluorescent-lighting units.

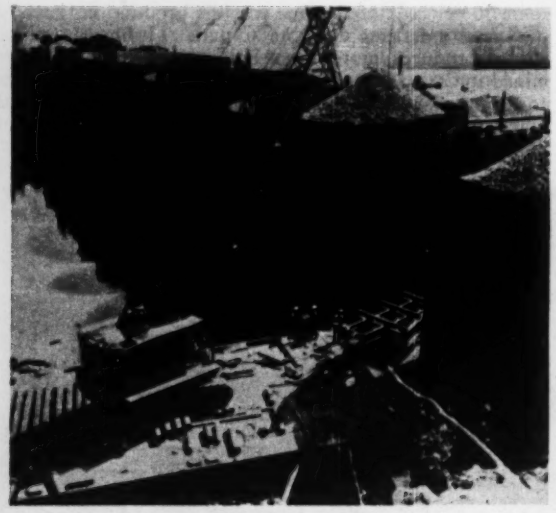
The uses of asbestos fiber are unlimited and research and development by companies like Johns-Manville continually develop new uses for the strategic mineral, it was pointed out. Products in which asbestos fiber is incorporated enable industry to produce more and better goods for more people at lower cost through industrial insulations, friction materials, packings, and other products.

Asbestos-cement Transite pipe for electrical conduit and water and sewage-disposal systems, and a wide range of building products serve the construction industry, reducing maintenance costs and providing protection for home and commercial structures against fire, weather, and wear, a company official pointed out.

In 1953 production of asbestos fiber in Canada amounted to 911,713 tons at a value of $87,633,124. This was 65 per cent of the free world's asbestos production. Of this output, 97 per cent was exported, mainly to the United States. The United States, which consumes some 70 per cent of the free world's production, gets 70 per cent of its supply from Canada. Johns-Manville, alone, produces more than half of the asbestos fiber mined in Canada, providing jobs for more than 2600 men and women at the Asbestos, Quebec, mine, mill, and plant operation with an annual payroll in excess of $10,000,000.

Fig. 13 Aerial view of new mill at Canadian Johns-Manville Jeffrey Mine, Asbestos, P.Q., now half completed, also shows in the background the town of Asbestos and other mining and milling facilities. At left foreground is the dry-rock storage building with a capacity of 60,000 tons of ore; beyond are some of the old milling facilities which the new mill will replace. In middle center is the headframe above one of the two underground mine shafts in operation at the Jeffrey Mine.

Engineering Developments . . . at a glance

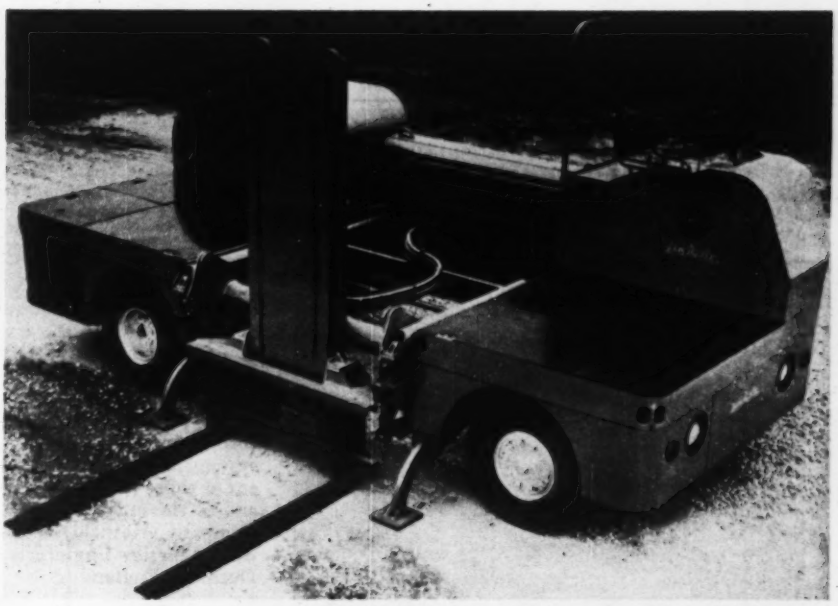


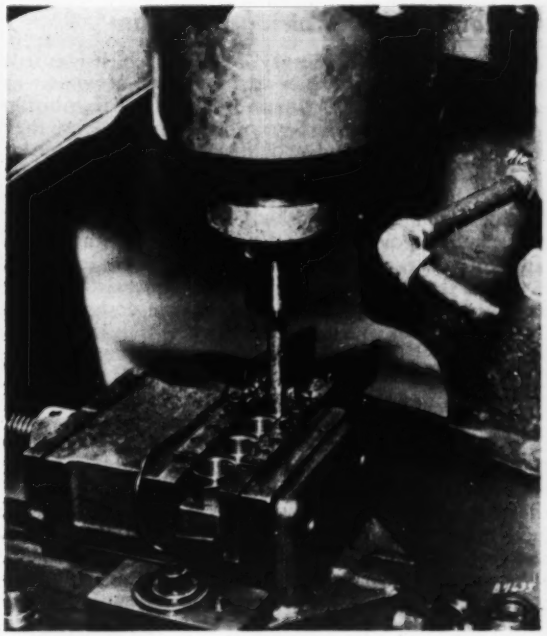
Old Hickory Powerhouse. Shown here in the preliminary stages of construction is an $8,950,000 powerhouse now being built at Old Hickory, Tenn., on the Cumberland River. The 100,000-kw powerhouse will have an estimated annual energy output of 420 million kwhr. It will be used to help alleviate a potential shortage of electric power in the mid-Tennessee area. To start construction, 11 cellular cofferdams, composed of steel sheet piling in 40 to 65-ft lengths, were erected. Coffer cells upstream averaged 48 ft in diam, while coffer cells downstream averaged 60 ft. To seal working areas, each coffer cell was filled with 4500 cu yd of sand and aggregate. A total of 120,000 to 130,000 cu yd of concrete will be required for the project. Farnsworth and Chambers Company, Inc., of Houston, are contractors for the project. Completion is expected in $3\frac{1}{2}$ years.

Welding Made Easy. Welding without touching his work, this amateur welder is using a new method, called Selfweld, to make a piece of iron furniture. Developed by The Lincoln Electric Company, Cleveland, Ohio, the method is said to make welding for the amateur as easy as turning on a light switch. The method employs a special electrode, electrode holder, and small a-c welding machine which makes it possible for a person without experience or training to make good welds. To weld, the tip of the electrode is held against the metals to be joined at the point where the weld begins. A switch on the holder is pressed to fire the electrode, and as the tip of the electrode is held against the metal, the weld is automatically made.

Lightweight Sealant Gun. This new-type lightweight sealant gun speeds sealing operations, lowers costs, and allows the operator to work much more effectively in close quarters. The gun was developed by Douglas Aircraft Company, Inc. Though the empty weight of the gun is less than 17 oz, it holds 30 per cent more sealing compound than conventional equipment of twice that weight. In operation, the sealant is extruded smoothly by means of a simple valve which has been tested through a million operating cycles at 100 psi. Upon release of the trigger, flow ceases immediately and automatically. Designed for aircraft-assembly applications, the new tool is equally adaptable for use with such other industrial caulking compounds as automotive, marine, and electrical sealants.

Side-Loading Fork Truck. This new version of a side-loading fork truck, called the Traveloader, has a lifting capacity of 10,000 lb. Made by the Baker-Raulang Company, it has a turning radius of 22 ft 7 in. and a standard lifting height of 144 in. Top forward speed is 30 mph; top reverse speed, 15 mph. The truck has improved load distribution, better stability, and higher tractive effort than previous side-loading models and can be used for delivery over highways and streets.





Power Brushing. Small wire brushes mounted on a tapping machine now are solving the problem of removing steel chips, which settle deep down in the threads of stainless-steel coupling nuts, and removing burrs of various kinds. Previously, removal of chips and burrs was done slowly by hand. Made by the Osborne Manufacturing Company, of Cleveland, Ohio, the wire brushes perform the operation quickly and accurately. The nuts, of various sizes, are fed by hand into a special fixture. The brush, with 0.005 stainless-steel wire fill, is driven down into the nut at 100 fpm, reversed and brought out at 200 fpm.

60-in. Aluminum Mill. Aluminum foil is shown being inspected on the "feed" side of Kaiser Aluminum & Chemical Corporation's new 60-in. aluminum mill. The new four-high mill is capable of speeds up to 3000 fpm and boosts the Permanente, Calif., plant's rated annual capacity from 12 million lb to 18 million. Foil up to 54 in. wide—the widest made in the west and equal to the widest produced in the nation—can be produced in the mill. The greater width lends itself to better control of the quality of the foil at the mill thus allowing further processors greater production for the same machine time.

European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree, Mem. ASME, *European Correspondent*

Fig. 1 Handling machine for aluminum slabs and ingots

Aluminum-Ingot Handling Machine

In the aluminum rolling mill recently completed at Resolven in South Wales, for Tube Investments, Ltd., to produce mill-finish sheet and coiled strip, the slabs of aluminum are transferred from the preheating furnaces to the roller feed table of the hot mill by a discharging machine which possesses some interesting features. It is illustrated in Fig. 1 and can handle single slabs up to 50 in. wide × 6 ft 6 in. long × 10 in. thick, weighing about 4000 lb. Alternatively, two smaller slabs can be handled at once, in which case the maximum thickness of each slab is 5 in. The machine picks the slabs off the conveyer on which they have traveled through the furnace and turns them over onto the feed table, so that both sides of the slab can be inspected before it is fed into the mill. The whole operation is carried out by hydraulic mechanisms, working at a maximum pressure of 1700 psi, the action of clamping being effected by a hydraulic telescopic cylinder and the turning movement by another cylinder which has a rack at the end of the piston. The complete hydraulic circuit for clamping and turning over has eight smaller circuits interlocked with it. There are four combinations of circuits by which either of the two pumps can operate either of the two machines, which are located side by side. Unless the slab is clamped securely the turnover mechanism will not function, and it cannot be unclamped while turning is in progress. The safety devices are very detailed, and even if a pressure pipe should burst while a slab is being turned over onto the table, the machine would merely stop, the slab being still firmly held. A leveling mechanism insures that the arms are adjusted automatically so that the slab is deposited gently on the feed rollers, in a truly horizontal positon. As the arms pass the vertical and begin to descend, separate hydraulic cirucits come into action to give an infinitely variable control of the speed of descent; and, as the arms reach the table, a cam brings in a further hydraulic circuit which brakes the machine and eases the slab down onto the rollers. It is impossible to turn the arms back until unclamping is complete. The machine is of fabricated-steel construction throughout and has its own automatic lubricating system; and the hydraulic circuits are entirely independent of those of the feed table, with its side manipulators, and of the mill. It was designed by E. H. Weston and Company, Hatfield, Hertfordshire, and was constructed by the Birtley Engineering Company of Birtley, County Durham, England.

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Machine-Tool Exhibition at Milan

When last month's "Survey" was written, it was still too soon to give more than a bare outline of what was contained in the fourth European Machine Tool Exhibition held in Milan, Italy, from September 14 to 23. Since then the European Correspondent of Mechanical Engineering has walked his feet flat in promenading for several days through the eight large halls of the Exhibition, under conditions of temperature and humidity for which England, this year, had provided no really adequate preparation and can testify that, as a demonstration of postwar industrial recovery, the display was even more impressive than he had been led to expect. Inevitably, the design of machine tools tends to become more or less stabilized along certain well-defined lines of development, mainly conditioned by the limitations of cutting tools, of drives, and of methods of control; yet it is curious to note how the machine tools of different countries seem to evolve, as it were, each a national physiognomy, differing in appearance in ways that are almost impossible to define but which are as characteristic as the physiognomies of the peoples who have produced them. The standards of mechanical perfection attained in the tools themselves, and in their products, show remarkable advances since the war and, it would seem, are rapidly attaining to the economic maximum, suggesting that the most hopeful line for further development is in lengthening the working life without loss of that high accuracy. The level of selling efficiency was also high among the Continental firms—especially, the Swiss, the Germans, and the Dutch, most of whom had representatives who could converse in two or three languages. Multilingual catalogs are now a commonplace, but there is still a rather surprising difficulty in obtaining reproducible photographs on demand, to supplement the technical information so freely dispensed, and in impressing upon many exhibitors that, by comparison with publishing deadlines, the famous Laws of the Medes and Persians are almost plastic.

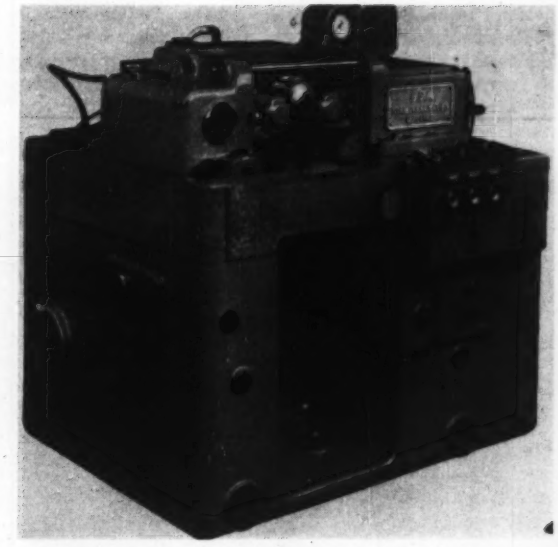


Fig. 2 B.S.A. Tools, Ltd., form generator for thread rolling

Form Generator

THE INCREASING use of thread rolling and similar applications of the principle of form generation was a noticeable feature of the Milan Exhibition, a large number of machines employing this method for one purpose or another. One British exhibit, not previously shown elsewhere, was the B.S.A. form generator illustrated in Fig. 2. It is made by B.S.A. Tools, Limited, Kitts Green, Birmingham, England, and is based on the Pee-Wee thread-rolling generator, but incorporates a number of modifications and is built entirely to British and American standards. It can roll deep forms such as Acme threads, worms, and gears in any material which has physical characteristics suitable for forming and will also produce multiple threads and taper threads. The range of size of the work is from $^3/_{16}$ in. to 3 in. diam, and the machine will accommodate rolls up to $6^3/_4$ in. diam and $6^1/_2$ in. maximum width. The space above the rolls is completely open so that any form of magazine attachment can be fitted to feed directly between the rolls. A spindle-reversing control is fitted for rerolling heavy components, and an electronic timer provides a precise control of the dwell period of the operating cycle. The roll speed is steplessly variable by means of a handwheel, and the working pressure can be anything up to 15 tons. The machine can be operated by hand when forming intricate components requiring individual attention; semi-automatically, when each cycle is initiated by hand and then automatically completed; or it may be run as a full automatic, the components being either inserted and removed by hand or supplied from a magazine or hopper. Either plunge rolling or through rolling can be carried out, depending on the length of the thread required.

A Water-Wheel Centenary

ON SEPTEMBER 27 there was observed in the Isle of Man, that interesting little self-governing "Dominion" in the middle of the Irish Sea, the centenary of a remarkable example of mechanical engineering, the Great Wheel at Laxey. It is the largest water wheel ever constructed, being 72 ft in diam and 6 ft wide, and when it was set to work on September 27, 1854, it was probably the largest wheel in the world, of any kind. It is a "pitch-backshot" wheel, that is, an overshot wheel in which the direction of the water is reversed under the flume which feeds it, and formerly drove the pumps in the lead mines, now abandoned, of the Great Laxey Mining Company.

The connection to the pumps was through 600 ft of horizontal oak beams, supported on top of a viaduct. The operating water supply came through a 2-ft pipe from a reservoir in the neighboring hills to the foot of a stone tower containing a vertical standpipe from which the flow discharged into the flume. A vane at the end of the flume deflected the water backward so that the top of the wheel rotated toward the tower.

The wheel has a cast-iron rim, with 188 buckets, and a 10-ton forged-iron axle, but the arms are of wood. The single crank, also of forged iron, gave a horizontal stroke of 10 ft to the rodding, but this was reduced by a bell-crank to 8 ft in the pump shaft. The maximum delivery was about 250 gpm from a depth of 1200 ft. The wheel is still workable, but the pumps have been disconnected and it is now maintained solely as a showpiece. The designer was a local engineer named Robert Casement, who died in 1892 at the age of 77. Recently, a Danish member of the (British) Newcomen Society, Anders Jespersen, of Virum, Denmark, has written a book about the Great Wheel in which he has described and illustrated it in much detail and has gone into elaborate calculations of its performance.

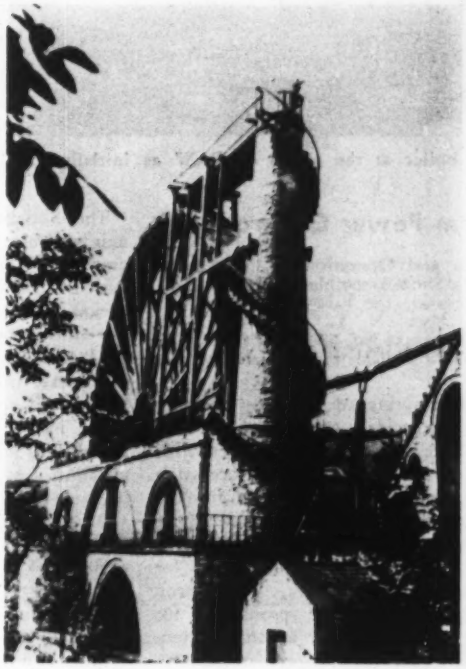
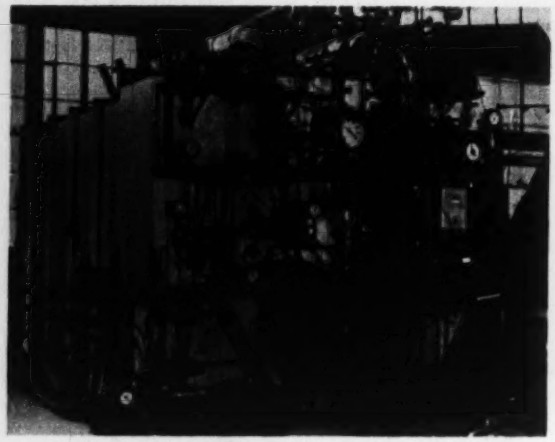


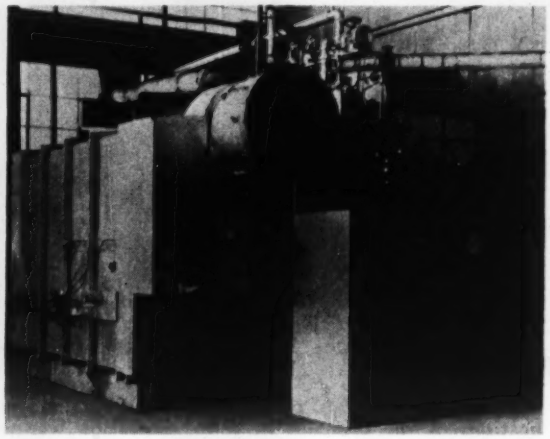
Fig. 3 The Great Wheel at Laxey, Isle of Man

ASME Technical Digest

Substance in Brief of Papers presented at ASME Meetings



Test boiler at the shops of B&W as initially installed



B&W test boiler after automatic controls were developed

Steam Power Generation

Design and Operation of Fully Automatic Shop-Assembled Boilers, by E. A. Kazmierski, The Babcock & Wilcox Co., New York, N. Y. 1954 ASME Fall Meeting paper No. 54—F-30 (multilithographed; available to July 1, 1955).

In the spring of 1949 the author's company decided to market a shop-assembled oil or gas-fired boiler with controls for fully automatic operation with as many as possible of the following features: Shop assembly for ease of installation, water-cooled furnace to minimize maintenance, pressure firing for simplicity of operation, push-button starting, flame-failure protection for safety, and completely automatic combustion controls co-ordinated with burner and boiler for maximum efficiency, simplified operation, and ease of installation.

The first commercial installation went into service early in 1950. Since then others have been started up at an average rate of about 10 per month. Their field of application has included: Laundries, hospitals, schools and colleges, oil refineries, bakeries, printing plants, paper mills, steel mills, canneries, rubber plants, textile mills, chemical plants, foundries, machine shops, and railroad shops.

The shop-assembled feature makes the unit particularly adapted to plants that require additional steam capacity that must be installed in a minimum erection period, in replacing old equipment, or any other situation where plant operation is affected during installation.

For ease of operation all mountings are located at the front of the boiler. These include feed line and regulator, blowdown, water column, soot blower, chemical feed, in fact everything that needs an operator's attention.

Ability to fire oil or gas without any changes to the burner other than turning the control off one fuel and back on the other makes it possible to take advantage immediately of the most economical fuel.

The fully automatic-control feature which requires a minimum amount of attention from the operator permits its use in many plants where other equipment is not suitable.

In order to increase the safety of the automatic equipment the following interlocks are provided which will cause the boiler to shut down if: (*a*) Burner flame fails; (*b*) forced-draft fan fails; (*c*) boiler-drum water level is too low; (*d*) oil-pump motor fails; (*e*) lighter flame is too small to light the main burner; (*f*) oil temperature is too low; or (*g*) atomizing steam is not sufficient for proper operation of the oil burner.

Three types of combustion-control systems are offered with this boiler: Positioning-type electrical control, positioning-type pneumatic control, and metering-type pneumatic control.

Thermodynamics of Supercritical Pressure Steam Power Plants, by Jerome Bartels, Mem. ASME, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1954 ASME Fall Meeting paper No. 54—A-37 (multilithographed; available to July 1, 1955).

This paper deals with the efficiencies that are thermodynamically obtainable from a steam power cycle by utilizing throttle pressures exceeding the critical pressure of steam.

The analysis starts with Rankine cycles, and then successively presents simple cycles, multiple reheat cycles, and increasingly more complex feed-heating arrangements.

Thermal efficiencies and heat rates for these cycles are established, and explanations are offered to show why the results turn out the way they do.

The paper attempts to stake out the boundaries and to survey the level of efficiencies attainable in the area of supercritical pressure plant design. It points out the basic thermodynamic advantage of using H_2O at supercritical pressures in cycles which use high throttle temperatures.

Turbine-room heat rates of the Rankine cycle and the simple cycle are determined for throttle temperatures of 1000, 1100, and 1200 F over a range of throttle pressures of 0 to 8000 psia.

For a constant turbine-inlet temperature of 1200 F, the effects of adding one reheater and two reheaters are measured over a throttle-pressure range of 0 to 8000 psia with nonextraction operation.

The location of extraction points for feed heating is discussed, and a particular cycle is analyzed.

A tabulation of cycle performance is provided for designs encompassing various throttle pressures, temperatures, number of steam reheats, and number of stages of feedwater heating.

Reheat-Turbine Overspeed Protection, by C. L. Ringle, Mem. ASME, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. 1954 ASME Fall Meeting paper No. 54—F-31 (multilithographed; available to July 1, 1955).

THE problem of reheat-turbine overspeed protection after sudden electrical load dumps has existed since the first reheat unit went into operation. Many different arrangements and combinations of reheat intercepting and dump valves have been established and as many arguments presented as to their relative protective merits. The present trends are toward increasing use of reheat turbines for central-station installations as indicated by the fact that more than 90 per cent of the large units sold today are of the reheat variety. The higher pressures and temperature trends of the reheated steam further amplify the overspeed problem because of the higher accelerating potential of the steam in the reheat system.

This paper covers various aspects of the overspeed problems inherent in reheat turbines because of the large quantities of steam bottled up in the reheat system.

The relative merits of different protective devices or controls are considered and evaluated.

A planned program for maintaining and checking the good operational conditions of these controls is covered.

In conclusion, the paper states that the weight of evidence should favor the reheat trip stop valve, installed in series with intercepting valves, as the most effective reheat-protection combination. The consistent logic of providing the same type of protection to the reheat turbine as to the high-pressure turbine, i.e., governor-controlled admission valves backed up by trip stop valves, makes good sense. The fact that the reheat stop-and-intercepting valve combination is the most economical installation for "two-lines-of-defense" protection weighs heavily in its favor. For "single-line-of-defense" reheat protection, the relative merits of a pair of intercepting valves versus a pair of dump valves indicate about the same degree of protection, assuming good operational condition of the valves and controls. However, in the interest of obtaining the maximum protection possible on any unit installation, the policy of employing two lines of defense should be practiced.

Overspeed Protection of Reheat Turbine-Generators, by M. A. Eggenberger, General Electric Company, Schenectady, N. Y. 1954 ASME Fall Meeting paper No. 54—F-26 (multilithographed; available to July 1, 1955).

BESIDES the normal functions of control and protection, the control system of a reheat unit must be able to protect the turbine-generator effectively against

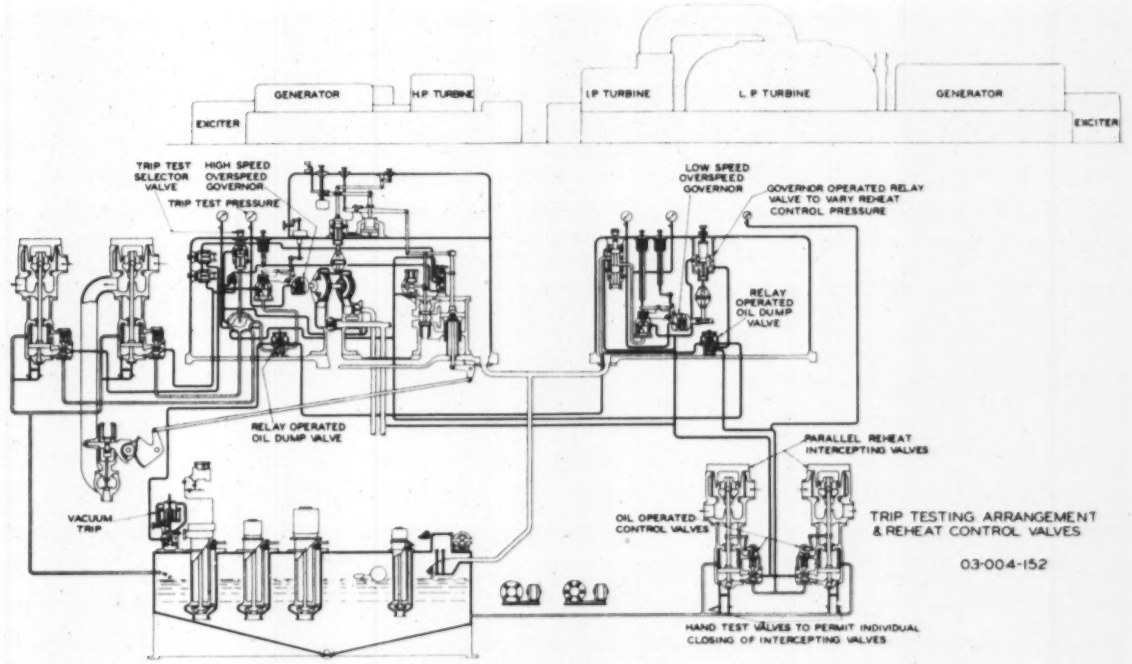


Diagram of trip-testing arrangement and reheat-valve controls. Each turbine rotor is equipped with an "overspeed emergency governor." Their trip systems are interlocked so that the action of either governor trips both systems. The overspeed governor can be exercised, without overspeeding the unit, by means of the "trip tester." This exercising will maintain the governor in operative condition and the pressure reading of the test oil, at which the trip occurs, gives a measure of the freedom from binding of all movable parts. Stop, intercepting, dump, or reheat valves should be exercised regularly.

excessive overspeed which could be produced by stored steam in the reheater. This protection originally was obtained by a single line of defense consisting of the pre-emergency control system which operated the intercept valve. However, as the development of reheat units progressed rapidly, it was found that the potential overspeed in the reheater on most units became so high that a second line of protection was needed in order to insure adequate safety.

This paper discusses the reasons why the author's company decided to install reheat stop valves as a second line of defense against stored energy in the reheater.

It also describes methods of calculation used to determine the maximum speed which would be reached if a single line of defense would fail to operate and discusses other methods of secondary protection.

Special design features of the reheat stop valve originated by the author's company are:

1 Venturi-shaped inlet and outlet to reduce pressure drop.

2 Stem seal on valve stem, which allows large clearances and avoids steam leakage along the stem, thus reducing the rate of oxide build-up considerably.

3 No small clearances in the steam path unprotected by the stem seal.

4 External calibrated by-pass which can be blanked off for hydrostatic pressure test of reheater.

5 Fail-safe and quick-closing design of operating mechanism.

6 Dashpot to prevent the valve disk from slamming closed and spring-loaded rod pushing against disk in open position to prevent rattling.

7 Signal switches and testing provisions for remote test to fully closed position during operation.

The development of the overspeed protection of reheat turbines from the single intercept valve to the double protection with two parallel and fully testable sets of one reheat stop valve and one intercept valve in series is the result of four years' operation experience with a large number of units and also of the continuous careful study of newer and larger units in the design stage.

Operation experience has shown that in spite of the most careful design of the intercept valve, and even with regular testing, these valves can stick open for wholly unforeseeable reasons.

Continuous survey of units in the design stage has brought out that the potential overspeed has a clear trend to become higher the larger the units grow. With the direct cooling of the generators, another step toward higher potential overspeed is being made.

Even if the overspeeding of a unit would not cause serious damage, a forced shutdown for a thorough inspection would be necessary which is extremely expensive on very large units.

The second line of defense which has been introduced with the reheat stop valves is the answer to these problems and it is the result of the continuous effort to make turbine-generators more reliable and safer.

Evaluation of Nonflammable Fluids as Steam-Turbine Lubricants, by G. V. Browning and P. G. Ipsen, Mem. ASME, General Electric Company, Schenectady, N. Y. 1954 ASME Fall Meeting paper No. 54—F-36 (multilithographed; available to July 1, 1955).

THE need for a nonflammable lubricant for steam turbines has been apparent for some years. A survey of available hydraulic lubricants has been made but none of those which have been tested are suitable in their present form. Tests which have been used in this survey for evaluating fluids are discussed, together with a possible specification for nonflammable fluids, so that interested suppliers of fluids may consider development possibilities.

The paper concludes that there are fluids which would probably suffice now on the basis of nonflammability such as perfluorinated hydrocarbons, tricresyl phosphate, tetradichlorodiphenyl and, perhaps, polymethyl phenylsiloxanes and water-based fluids. The perfluorinated hydrocarbons are at present very costly and have very poor viscosity temperature-dependence properties. Chlorinated compounds, which have been tested, have shown marked corrosive tendencies in the presence of water. Phosphate esters appear to hydrolyze with sludge formation. Silicones do not appear to be sufficiently nonflammable.

Water-based fluids have shown a low rate of flame transfer and, in at least one formulation, have passed the ASTM oxidation test. Modifications of the formulation made to obtain an even longer life in the oxidation test, however, have not been satisfactory. This illustrates the need for further study of this fairly complex formulation. Also, the problems associated with loss of water by evaporation and gain in water due to a possible steam leak must be resolved.

In general, it seems that the materials which have been tested are not suitable as nonflammable lubricants for steam-turbine use. However, it may be possible by further work with chemical manufacturers, to modify satisfactorily one of the presently available fluids or to develop a new type of fluid.

Factors Influencing Steam Turbine-Generator Unit Overspeed, by E. G. Noyes, Jr., Assoc. Mem. ASME, Westinghouse Electric Corp., Philadelphia, Pa. 1954 ASME Fall Meeting paper No. 54—F-25 (multilithographed; available to July 1, 1955).

THE speed and output of a modern reheat turbine-generator unit is controlled by limiting the steam flow with governing or stop valves. The energy of entrapped steam or flashed condensate not under the control of the turbine governing system may result in a dangerous speed rise of the turbine-generator unit in the event the electrical load is lost.

Controls are provided either by the turbine manufacturer or the user to limit the admission of this energy to the turbine. Since, under some adverse conditions, the protective devices may become inoperative, it is desirable to know the potential overspeed which would result for failure of these controls to function.

This paper presents a method for determining the potential overspeed of turbine-generator units which would result from such a failure.

Fuels Technology

The Burning of Sulphate, Soda, and Sulphite Waste Liquors, by E. H. Kennedy, Combustion Engineering, Inc., New York, N. Y. 1954 ASME Fall Meeting paper No. 54—F-32 (multilithographed; available to July 1, 1955).

SULPHATE, soda, and sulphite waste liquors are the residual liquors left after wood or other cellulose-bearing material has been digested with certain chemical solutions and the cellulose fibers separated therefrom.

In general, it may be said that sulphate waste liquor remains after digestion with sodium hydroxide and sodium sulphide. Soda waste liquor remains after digestion with sodium hydroxide. Sulphite waste liquor remains after the digestion with calcium, ammonium, sodium, or magnesium bisulphite solutions. The waste liquor contains these inorganic chemicals alone and combined with the lignins and resins of the wood which bound the cellulose fibers together. It also contains sugars and organic acids. In the furnace the organic carbonaceous material is burned and the inorganic chemicals are smelted and recovered.

A brief history of waste liquor burning and the trend in the design of waste-heat and chemical-recovery units is presented. The source and preparation of the fuel and methods of burning are discussed.

Typical analysis of waste-liquor solids are compared and their use in the construction of combustion-characteristic curves is outlined.

The ultimate analysis of the waste-liquor dry solids and the determination of other physical properties of the concentrated waste liquor play an important part in the design of the recovery unit and its accessories. From the ultimate analysis of the dry solids, combustion characteristic curves can be calculated and plotted from which gas and air weights are determined for a given per cent excess air. Knowing these weights and the heat input, furnace, superheater, boiler, economizer, and air-heater surfaces can be proportioned properly and the amount of steam generated can be calculated for a given-size recovery unit.

The modern recovery unit has now become an efficient and reliable steam generator with as high an availability factor as other types of steam generators fired with other fuels.

Design and Operational Aspects Regarding Utilization of North Dakota Lignite in Steam-Generating Units, by H. R. Cowles, Mem. ASME, Otter Tail Power Co., Fergus Falls, Minn. 1954 ASME Fall Meeting paper No. 54—F-2 (multilithographed; available to July 1, 1955).

This paper covers briefly the latest lignite-fired boilers installed in the North Dakota area and presents important items of station design for lignite utilization. It shows the progress and practical experiences in the art of utilizing a high-moisture lignitic fuel such as found in North Dakota, and also the uses to which the industry soon may put the data we now have.

The variable nature of the material creates problems. However, by intimate association with the existing lignite-fired power stations; installing a boiler that is conservative in rating and adequately equipped with soot blowers, fans, and superheat control; and remembering that the operating personnel have to live with lignite when, for a week, the outside temperature can average 28 deg below zero, the design engineer can be confident that his client ultimately will have a trouble-free lignite-burning power plant.

The current operational data for existing boiler units is sufficient evidence to show that there are no mysteries to the successful burning of North Dakota lignite in boiler sizes up to 230,000 lb per hr. Modern boiler techniques have been found to be adequate when altered in accordance with the characteristics of the fuel to be burned.

The modern trend is definitely away from the chain grate for medium-sized units, primarily because of characteristic load response. The spreader units can be favored for sizes up to 200,000 lb per hr.

The pulverizer should increase in numbers as present-day economics demand larger-size boiler installations. Further research may be required to show that the cyclone burner has its place in the field of lignite burning.

Two 230,000-lb per hr pulverized-fired boiler units have now been in operation for over two years. The burner flame is quite stable and the plant operators report that they have experienced no more than normal operating difficulties.

A 250,000-lb per hr continuous rated 975-psi drum pressure 905 F superheater-outlet-temperature boiler near Mandan, N. D., is under construction at the present time. This unit is fired with a continuous-discharge spreader stoker and will be the largest North Dakota lignite-fired unit installed to date.

The operation of the Mandan spreader-fired unit will witness a unit that is 56 per cent larger than the largest similar unit now in operation. The successful operation of this new boiler will provide an even greater field for the consideration of the spreader in the field of lignite utilization.

Now that industry can plan safely for much larger units, it also must plan to handle not 300 to 500 tons of fuel per day as in the past, but 1500 tons to 3000 tons per day. Modern methods of handling materials have no difficulty in moving 3000 tons per day. However, the character of the raw material (lignite), coupled with the severity of the weather which is associated with the economic utilization of the area fuel, produces problems.

Blowing snow or actual blizzard conditions can fill uncovered hoppers rapidly, resulting in an actual snow-and-coal compound going to the firing equipment.

Coal-unloading crews who are provided with adequate equipment and facilities can do a much more efficient job of providing the plant with fuel than can those who have open, drafty, and poorly lighted facilities. Blizzard conditions and sub-zero temperatures are only two examples that must be considered.

Heat Transfer

Boiling From Wires With Emphasis on Transition Phenomena, by W. M. Van Camp, Purdue University, Lafayette, Ind., and C. R. St. Clair, Motor Wheel Corp., Lansing, Mich. 1954 ASME Fall Meeting paper No. 54—F-33 (multilithographed; available to July 1, 1955).

The results of an investigation of a typical "boiling curve" are presented in this paper.

Free-convection heat-transfer coefficients were determined experimentally for small horizontal wires submerged in ethyl alcohol at atmospheric pressure.

Results indicate the following:

1 A definite discontinuity or jump exists in the boiling curve in the transition region between free convection and nucleate boiling for increasing wire currents. The heat-transfer mechanism in this region is unstable, the data following two different paths depending on the direction of traverse of the boiling curve. This discontinuity may be due to the small radius of curvature of the heating surface.

2 The maximum temperature difference attainable in free convection before the start of nucleate boiling is apparently influenced by the following: The cleanliness and smoothness of the heating surface, the wire diameter, and the rapidity and magnitude of data steps leading up to first appearance of nucleate boiling.

3 The data are reproducible for both the annealed and unannealed heating surfaces.

4 The free-convection data may be correlated in the conventional manner using the Nusselt, Grashof, and Prandtl moduli.

5 The positive and negative slope portions of the heat flux versus temperature-difference curve apparently represent stable and unstable phenomena, respectively.

6 Annealing the heating surface has a negligible effect on the film coefficient in the free-convection region, but appreciably increases the nucleate boiling coefficient at a given temperature difference.

Discussion of Local Heat-Transfer Coefficients for Spheres and Cylinders, by Irving Korobkin, Assoc. Mem. ASME, U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md. 1954 ASME Fall Meeting paper No. 54—F-18 (multilithographed; available to July 1, 1955).

Existing theories and experimental data for local heat transfer on spheres and cylinders with laminar incompressible boundary layers are compared and discussed.

The theory and experiment are in good agreement for the case of the cylinder but recent theoretical and experimental results obtained for spheres by Cary disagree with previous theories. Though Cary's theory and measurements are in good agreement with each other, his values are about $1/2$ as large as those predicted by previous theory.

A critical examination of the Cary paper indicates the possibility of error in the theoretical presentation and the possible existence of uncorrected heat-conduction effects in the experiment. It is evident that additional experimental work on spheres is necessary for comparison with theory.

Heat Transfer in the Rotating-Element Air Preheater, by C. M. Simmang, The A & M College of Texas, College Station, Texas; F. T. Saadeh, Minneapolis-Honeywell Regulator Co., Dallas, Texas; and B. E. Short, The University of Texas, Austin, Texas. 1954 ASME Fall Meeting paper No. 54—F-22 (multilithographed; available to July 1, 1955).

SEVERAL analytical and experimental studies of the moving surface or rotating-element regenerative heat exchangers have been made. These studies have been based, in several cases, upon steady-state conditions for the heat-transfer surfaces although it has been recognized that the elements were heated and cooled alternately.

This paper presents experimental results to show the effect of the plate thickness, for a plate-type matrix for the rotor, and the time of contact of the "hot" and "cold" air on the total heat-transfer rate from the hot air to the plate or from the plate to the cold air.

It also compares the experimental results with an analytical procedure for transient flow which is based on the assumption that the plate is alternately immersed in constant-temperature hot air and constant-temperature cold air.

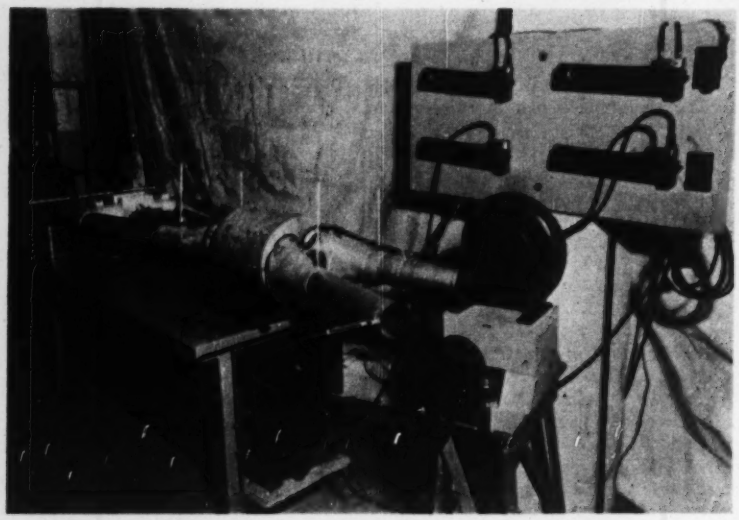
In this analytical procedure it is assumed that the stream at exit from the rotor is mixed thoroughly so as to give a uniform temperature of each fluid at exit. It also is assumed that the air temperature for both hot and cold streams varies linearly with length of passage through the rotor.

Some conclusions reached are as follows:

Heat-transfer coefficients in the rotating-element heat exchanger do not appear to differ appreciably from those in the stationary-surface type.

Speed of rotation lessens the time of contact of the plates with the fluid and affects the plate-temperature change but has no effect on the total heat transferred within the speed range of these experiments.

Plate thickness has no effect on the total heat transferred for the same terminal temperatures and fluid velocities. The effect of the plate thickness is in its effect on the weight of the rotor for the same heat-transfer surface, a thin plate being usable for this type exchanger where it would not be structurally acceptable for an exchanger with the fluids separated by the plate material unless the pressures were equal.



Assembled test apparatus is shown as viewed from the blower end, i.e., the cold-air entry and the hot-air discharge. An impact tube (calibrated by pitot-tube traverse) for measuring the cold-air and hot-air flow rates may be seen in the end of the duct for discharging the hot air. The motor-gear variable-speed drive with connecting V-belts for the rotor may be seen in position directly beneath the test unit. At the bend of the U-shaped duct may be seen the electrical heating-circuit box and the variable transformers for the control of the air heating.

Heat-Transfer Rates for Crossflow of Water Through a Tube Bank at Reynolds Numbers Up to a Million, Part I, by T. V. Sheehan, Mem. ASME, and O. E. Dwyer, Brookhaven National Laboratory, Upton, L. I., N. Y., and R. T. Schomer, Mem. ASME, The Babcock & Wilcox Co., New York, N. Y. 1954 ASME Fall Meeting paper No. 54—F-19 (multilithographed; available to July 1, 1955).

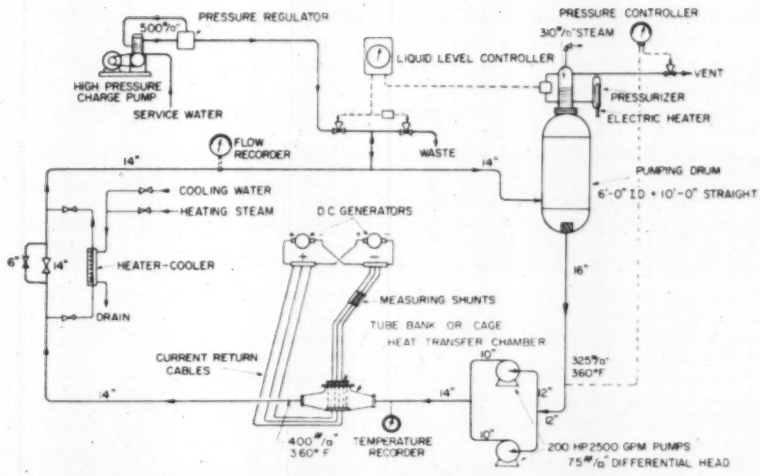
HEAT-TRANSFER coefficients have been obtained at high Reynolds numbers for crossflow of high-temperature, high-pressure water through a tube bank consisting of 200 tubes. The tubes were 0.810 in. OD and spaced on an equilateral-triangular grid $1^{9}/_{32}$ in. between centers. To the authors' knowledge, this study is the first of its kind using water and the first exceeding a Reynolds number of about 50,000 for any fluid.

In the range of Reynolds numbers investigated, the coefficients were found to be considerably greater than those predicted by extrapolation of the Colburn equation. For example, at a Reynolds number of 1,000,0000, the coefficients are about 60 per cent greater. This increase is due to the fact that in the Reynolds number range 10^{5}–10^{6}, the coefficient was found to vary approximately as the 0.8 power of the Reynolds number instead of 0.6, as indicated by the Colburn equation. Increase in this exponent at the higher Reynolds numbers is shown to be consistent with heat-transfer results on single cylinders; with pressure-drop data; and with mass-transfer data.

In the last two cases, analogy between mass, heat, and momentum transfer is implied. The coefficients increased from the first to the third transverse row of tubes, after which they remained constant.

At Reynolds numbers of 10^{5} and 10^{6}, the coefficients for the tubes in the first transverse row were approximately 30 and 40 per cent, respectively, below the average coefficient for the lattice as a whole. The tubes near the two side walls gave average coefficients which were about 15 per cent higher than those in the interior of the lattice.

The heat-transfer research described in this paper should be of interest for two reasons: (*a*) The experimental conditions were new, and (*b*) the size of heat-transfer facility was unusually large for one



Equipment flow sheet. Hot water from the pumping drum entered the suction nozzles of two 3000-gpm single-stage centrifugal pumps. The pumps boosted the water pressure from 325 psig to 400 psig and discharged to the heat-transfer chamber. This was a flanged casting about 2 ft sq, 6 ft long, with the tube bank attached to the top cover which was volted to the chamber. After leaving the heat-transfer chamber, the water returned to the pumping drum through the 14-in. main. The system held about 4000 gal of water, giving a recycle time of about 1 min.

designed purely for experimental purposes. The reason for carrying out the research program was to obtain dependable design data for a heat-exchanger system in a nuclear power plant. The scale of operation is indicated by the fact that the entire facility cost in the neighborhood of $150,000; required a minimum of three men to operate it; and circulated hot high-pressure water, the heat-transfer medium, at rates up to 6000 gpm.

Heat-Transfer Rates for Crossflow of Water Through a Tube Bank at Reynolds Numbers Up to a Million. Part 3—Forced-Convection Boiling and Pressure-Drop Data, by O. E. Dwyer, F. L. Horn, and Joel Weisman, Brookhaven National Laboratory, Upton, L. I., N. Y. 1954 ASME Fall Meeting paper No. 54—F-21 (multilithographed; available to July 1, 1955).

As PART of an extensive experimental study, heat-transfer data have been obtained for crossflow of water through a staggered-tube bank under conditions of forced-convection boiling.

The effects of pressure, heat flux, and flow rate on the inception of nucleate boiling were determined. The effects of these variables on the heat-transfer rate under boiling conditions and in the transition stage between nonboiling and full-surface boiling also were studied.

Moreover, the variation of the local coefficient around the circumference of a tube, under both nonboiling and boiling conditions, was determined. In going from nonboiling to boiling conditions, considerable increase in the average coefficient was observed, with the greatest increase occurring in the vicinity of 70 to 80 F from the forward stagnation point. The heat-transfer data were taken at Reynolds numbers in the 10^5–10^6 range.

Pressure-drop results also were obtained. They were found to be consistent with previously published experimental data obtained at lower Reynolds numbers.

Heat-Transfer Rates for Crossflow of Water Through a Tube Bank at Reynolds Numbers Up to a Million. Part 2—Circumferential Variation of Film Coefficient for Individual Tubes, by O. E. Dwyer, T. V. Sheehan, Mem. ASME, and Joel Weisman, Brookhaven National Laboratory, Upton, L. I., N. Y. 1954 ASME Fall Meeting paper No. 54—F-20 (multilithographed; available to July 1, 1955).

THE tube bank used in this study consisted of 200 tubes, 10 wide and 20 deep. They were made of nickel, had an OD and thickness of 0.810 and 0.063 in., respectively, and were spaced on equilateral-triangular centers, 1.28 in. apart.

Purpose of the work was to determine the circumferential, or angular, variation of the film coefficient for individual tubes at various locations in the tube bank, with water flowing at 360 F and Reynolds numbers in the range 28,000 to 1,200,000.

Compared to results on air, the angular variation of the coefficient in the present system was found to be surprisingly small. As expected, the absolute variation of the coefficient increased with flow rate. However, throughout most of the range of Reynolds numbers investigated, the maximum deviation of the coefficient from the average, for a given tube, was found to be in the neighborhood of 15 to 20 per cent. A few runs around a Reynolds number of 500,000, however, gave relative deviations appreciably less than this.

For Reynolds numbers below 5×10^5, the maximum coefficient was found at the forward stagnation point. For higher Reynolds numbers, maxima occurred at about 80 deg from this point on either side of the tube. In all cases the rear stagnation point showed minimum values of the coefficients.

Within the precision of the results, both the left-hand and right-hand sides of a tube facing downstream gave the same coefficient profile. Because of the relatively small variation of the coefficient around the tube circumference, temperature variation was also small, and circumferential heat flow negligible.

It is estimated that, in general, the experimental results show an average deviation from the drawn-by-sight curves of less than 5 per cent and have a probable error of about 10 per cent.

Metal Processing

A Modern Perspective of the Grinding Process, by H. R. Letner, Mellon Institute, Pittsburgh, Pa. 1954 ASME Fall Meeting paper No. 54—F-4 (multilithographed; available to July 1, 1955).

GRINDING is a process which employs either bonded or loose abrasives to generate new surfaces on solid materials. In metalworking, it is regarded as one of the forms of metal cutting, comparable to milling or shaping. It is used advantageously to remove excess stock economically to improve the appearance of surfaces, to obtain high dimensional accuracy, and to generate surfaces of specified finish. One characteristic of the grinding process upon which there seems to be general agreement is that the abrasive removes discrete particles or chips from the surface being ground.

There is considerably less agreement concerning the nature of polishing. One view holds that it is continuation of the grinding process on an extremely small scale. Electron micrographs show that the dimensions of polishing powders extend down to the microinch range and that chips which are formed are even smaller than the particles producing them. Another view holds that polish-

ing is primarily a process of plastic flow of the surface material which results in the formation of an amorphous layer. There is electron-diffraction evidence for this behavior.

These views are not necessarily irreconcilable. It can be demonstrated that the surface of glass, plastic, or metal flows during grinding and that the amount of flow depends upon the grinding conditions. Since chips unquestionably are formed in this process, it is not inconceivable that polishing is also a process of simultaneous chip formation and plastic flow. Chemical reaction, which appears to be a factor in grinding, may be even more important in polishing.

Much has been written about the deleterious effects of abusive grinding upon the service life of ground parts. Unquestionably, abusive grinding can damage a surface but that is not sufficient reason for foregoing the efficient stock removal, fine finishes, and dimensional accuracy which good grinding practice affords. Tarasov and Grover have found by fatigue tests that the endurance limit of ball-bearing steel is reduced 20 or 25 per cent by severe grinding. Gentle grinding, on the other hand, gives the same endurance limit as the best-recognized methods of preparing fatigue specimens. It is thus apparent that the grinding conditions are extremely important in determining both the appearance and the serviceability of ground parts.

The author examines grinding processes from the theoretical as well as the practical aspects. The effect upon the abrasive, upon the chips produced, and upon the work is discussed in some detail.

A Correlation Analysis of Machining Standards, by R. D. Wills and Vernon Keenan, Stevenson, Jordan, and Harrison, Inc., Chicago, Ill. 1954 ASME Fall Meeting paper No. 54—F-23 (multilithographed; available to July 1, 1955).

TIME standards are normally used for two major functions: (1) The payment of wage incentives and (2) the control of production facilities. In either case their utility is governed largely by the accuracy of the standards and by the cost of setting the standards.

From the beginning, time study has been characterized by an emphasis on the accuracy of time standards. A great deal of attention has been given to timing devices, data collection, and methods of observation. The result has been a high level of quality generally for time-study data.

It appears, however, that further improvements in the accuracy of time standards will be of decreasing usefulness unless some way can be found to gather the data together more economically.

The approach suggested by this paper is to analyze time-study data in an effort to uncover relationships between them.

These relationships then can be used to formulate general principles or laws which would unify the data. Having brought them under a theoretical framework, their application would be simplified—concepts are manipulated much more readily than mazes of individual observations.

This report concerns a method for time-standards determination which is based upon the statistical analysis of a number of the physical variables of manufacturing operations rather than upon a summation of the times required for each "element" of the operation.

An attempt was made to subject the method to an empirical verification with sample data from a production-lathe center. It was found that the method could cope satisfactorily with the data and that two major improvements were effected in the procedure for routine standards determination: (1) The time required to set standards was reduced by 80 per cent, and (2) a relatively unskilled person could be substituted for the engineer previously required.

The Incompatibility of Predetermined Time Systems, by L. C. Pigage, Mem. ASME, and I. L. Reis, Assoc. Mem. ASME, University of Illinois, Urbana, Ill. 1954 ASME Fall Meeting paper No. 54—F-5 (multilithographed; available to July 1, 1955).

PREDETERMINED time systems are based on the three variable factors of: (*a*) Type of equipment, (*b*) degree of control exercised, and (*c*) the distance of the movement. For any one combination of the three variable factors, a corresponding time value should result.

Therefore, for each type of motion, or movement, a time-distance-control diagram and surface can be developed. Since each system of predetermined times is based upon the same fundamentals, the time-distance-control diagrams should be compatible. This paper investigates the lack of compatibility of three well-known predetermined time systems for selected types of motions.

Avoiding the question of proper methods of making allowances, which differ in the various systems, and avoiding further questions on the time effects of the interrelationship of motions, it is still possible to examine the specific motion categories and compare the time values established by each system. That there is some difference becomes evident simply upon observation of the published data. Part of this difference, however, can be ascribed to the different bases upon which the time values are established.

One system sets forth its time values as normal, nonincentive rates, for example, while another uses times set at a level which can be bettered by the average qualified incentive operator by a certain percentage.

Even after allowance is made for the use of different bases, there still remains a significant difference among the time values in the same motion categories of the various systems. One authority suggests that this difference can be explained by means of a "total-surface" concept. He suggests that the basic information on which any predetermined time system rests is contained in a single time-distance-control surface for any motion. The "control" dimension represents such factors as degree of precision, weight handled, and muscular control required. "Distance" represents the length of the motion, and the "time" is, of course, the time required to perform the motion.

It appears that for the three systems studied, at least, it is not possible to say whether all are derived from one basic time-distance-control surface stemming from the movements of operators performing work. If they do come from such a surface, then it appears that there were serious errors in the derivation of the data from the basic information into the published systems. If they are each equally accurate, yet do not come from such a time-distance-control surface, then considerable doubt is cast upon the existence of a fundamental time-distance-control surface and therefore upon the whole concept which serves as the foundation for universally usable predetermined times.

An Investigation of Cemented Tungsten Carbide as Bearing Material, by J. S. Kozacka, Mem. ASME, University of Illinois, Chicago, Ill.; H. A. Erickson, Mem. ASME, D. A. Stuart Oil Co., Chicago, Ill.; H. W. Highriter, Vascoloy-Ramet Corp., Chicago, Ill., and A. S. Gabriel, Acme Industrial and Acme Scientific Co., Chicago, Ill. 1954 ASME Fall Meeting paper No. 54—F-3 (multilithographed; available to July 1, 1955).

THIS report is a continuation of Report No. 1 which was presented at the 1952 ASME Annual Meeting. The investigation is principally concerned with the

effects of higher bearing pressures than previously used on bearing performance, the effect of bearing roughness surface on coefficient of friction, and the effects of speed on coefficient of friction under otherwise constant conditions. In these tests the same bearings were used as for tests previously reported. These bearings and journals were made of straight tungsten carbide with 6 per cent cobalt as the binder.

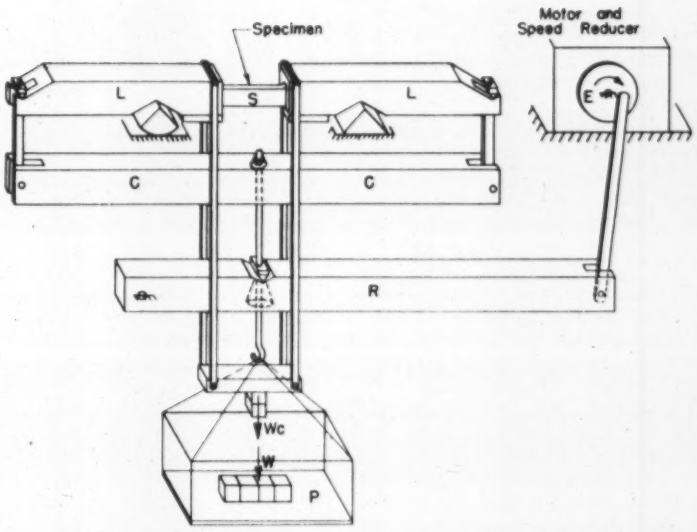
Test data indicate that for bearings made of cemented tungsten carbide with journals also made of the same material at constant speed 2750 rpm, using oil No. 4 as the lubricant, the coefficient of friction is nearly the same for the three bearings up to a bearing pressure of 500 psi regardless of surface finish, provided that the surfaces are reasonably smooth. Above 500 psi bearing A develops frictional losses at an accelerated rate due primarily to some metal-to-metal contacts between the irregularities of the bearing to the journal. Bearing C, which has a fine finished surface, develops the smallest frictional losses and these are nearly constant up to the highest pressure used in the test. Bearing B, having a rougher surface finish than bearing C, develops higher frictional losses than bearing C but not so high as bearing A.

The coefficient of friction of the three bearings plotted as a function of the operating variable ZN/P shows a straight line for bearing C, while there is a reversal of the trend in the thin-film region for bearing A and B at approximate value of ZN/P equals 60. In the thick-film region the friction lines almost coincide and for practical reasons can be considered to be the same.

Tests on bearing A were discontinued when the temperature of 115 C or 239 F was reached as it was assumed that this temperature was too high for operation of the bearings, using oil No. 4 as the lubricant.

Tests of cemented tungsten-carbide bearings at constant pressure 884 psi at variable speeds, taking readings at 45 C, indicate within the limits of this investigation a decrease in coefficient of friction for bearings with rougher than 10 microinches of finish and approximately constant coefficient of friction for bearing 8 to 10 microinches of finish. Use of EP base additive on bearing performance was especially beneficial, particularly for bearings with rougher finish.

Tests of cemented tungsten-carbide bearings to determine the time required for the bearing to develop enough heat to raise 22 cc of oil No. 4 as the lubricant from 35 C to 50 C at constant speed and constant pressure is inversely proportional to bearing roughness.



Schematic diagram of beam-loading apparatus. The beams were loaded repeatedly through 1000 cycles in the apparatus shown here. The load W on the weight platform P was transferred to the member C, which through the levers L applied a pure bending moment to the specimen S. The small load W_c was used as a counterweight. The beam R, which was reciprocated by the motor-driven eccentric E, alternately removed and reapplied the load to the member C. A speed reducer was employed to obtain a loading rate of approximately 4 cpm. At this relatively slow rate dynamic effects were negligible.

Metals Engineering

The Influence of Repeated Loads on the Residual Stresses in Inelastically Deformed Beams, by T. M. Elsesser and H. T. Corten, University of Illinois, Urbana, Ill. 1954 ASME Fall Meeting paper No. 54—F-13 (multilithographed; available to July 1, 1955).

THE importance attributed to the initial residual stresses in a machine member presumes that the residual stresses remain unchanged throughout the service life. However, the occurrence of inelastic deformation accompanying repeated loading will alter the residual-stress distribution.

This investigation was undertaken to determine the changes resulting from repeated cycles of overload in the residual stresses induced during the initial overload in beams loaded from zero to a maximum.

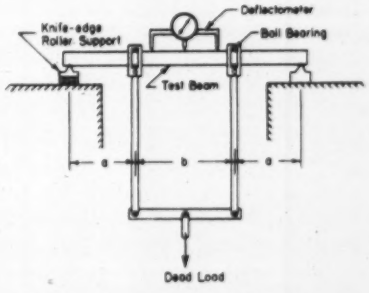
Tests were conducted on beams of rectangular cross section made from medium-carbon (SAE 1035 and SAE 1045) and alloy (SAE 4340) steels.

Two methods were employed to measure the residual stresses. Both methods indicated an increase in the residual stresses in the outermost fibers of the beams with increasing numbers of load repetitions.

It was found that additional inelastic deformation occurred during load cycles after the first, particularly in the medium-carbon-steel beams.

The Effect of Size on the Load-Carrying Capacity of Steel Beams Subjected to Dead Loads, by O. M. Sidebottom, Mem. ASME, and M. E. Clark, University of Illinois, Urbana, Ill. 1954 ASME Fall Meeting paper No. 54—F-12 (multilithographed; available to July 1, 1955).

WHEN mild-steel members are subjected to dead loads, catastrophic yielding occurs in the member at a stress level less than the conventional yield point, thus lowering the load-carrying capacity of the member below the expected value. The present investigation was under-



Sketch of sustained-load test setup. Beams were loaded to give a constant-moment section by the two-point loading shown here. The beams were loaded in the dead-load setup. The deformational behavior of each beam was determined either by measuring the deflection over a portion of the constant-moment section or by measuring the central deflection.

taken to determine if this type of action was dependent on the size of specimen.

A total of 18 geometrically similar rectangular mild-steel beams having depths of 3, 1, 1/2, and 1/4 in. were subjected to dead loads. The experimental hinge moment for the three largest sizes was independent of beam depth and the average value was found to be 9.3 per cent below the theoretical fully plastic moment. The average hinge moment for the 1/4-in. beams was 1.3 per cent above the theoretical. The increased load-carrying capacity is believed to be associated with the steeper stress gradient which appears to alter the spread pattern of yielding in the shallow beams.

A study also was made of the behavior under dead loading of beams made of a high-strength, low-alloy steel (Mayara R). Like mild steel, this material exhibits a definite yield point. Therefore the behavior of these beams when subjected to dead loads was also similar to that observed for mild-steel beams. The average experimental hinge moment was 10.7 per cent below the theoretical value.

Machine Design

Progressive Transfer of Skills From Operator to Machine, by W. G. Johnson, Norton Company, Worcester, Mass. 1954 ASME Fall Meeting paper No. 54—F-7 (multilithographed; available to July 1, 1955).

In approaching the design of automatic machines which will replace the skill of the operator, many problems arise which are dealt with by the author, using grinding-machine developments as criteria.

Whether economically it is advisable to attempt to replace the many skills of the human operator by mechanisms is open to question. Beyond a certain point of automaticity, the objectives can be gained only at the expense of added complications which may not be worth the cost. Development of the semiautomatic grinding machine, for example, has now been attained to meet a variety of requirements but its completely successful operation still depends on the skill of the operator.

The paper considers a conventional precision cylindrical grinder commonly available today, and what the machine does and what the operator as a human contributes. He places the work between centers and initiates the use of the power within the machine to rotate this work, traverses his wheel to remove the desired stock under conditions which the material and the machine will accept. He controls the size and the finish, readily making adjustments for the many variables involved when grinding. As he progresses he arrives at decisions by seeing and hearing, which result in such elements as size control, finish, wheel-wear adjustment, and wheel-dressing, and compensates at his will to remedy or correct.

To do these same things by removal of the services of man, many difficult mechanical problems must be solved. It is not too difficult to place work in and out of a machine but the masses and motions, as well as powers to accomplish such an operating mechanism, create considerable limitations on such elements as physical space, acceleration, deceleration, smoothness of operation, reliability of operation with minimum of wear and servicing.

Size control can be solved readily by modern design using electrical, hydraulical, or pneumatic arrangements with a high degree of amplification, telegraphing to some other control circuit the completion of the cycle of operation when the instrument and its mechanism has recognized the desired size.

Feeding motions for the grinding wheel have developed from simple manual operations to automatic type.

Control valves provide proper rate of motion and by solenoid control various rates may be selected and established by knife-edge orifice valves. We use knife-edge orifice valves to get results least affected by temperature changes and foreign material carried by the oil.

This final slow-down feed allows for release of spindle oil film, deflections, and other errors, giving the wheel the opportunity to develop the finish and size. Such control permits more rapid rate of stock removal when size and finish are not ready to be established.

Intermittent or continuous, or a combination-type infeed of the abrasive wheel has been a matter of mechanized control of the micrometer type of positioning mechanism used to move the wheel slide.

In approaching a grinding-machine design having transferred into its operation the skills of an operator, the importance of careful judgment of progressive accumulation of errors most always existing in individual components must be recognized. Temperature changes, mechanical tolerances of gears, feed screws, way fits, lubrication variances, diamond wear, and so on, must not be disregarded nor can they in simple inexpensive form be compensated for individually.

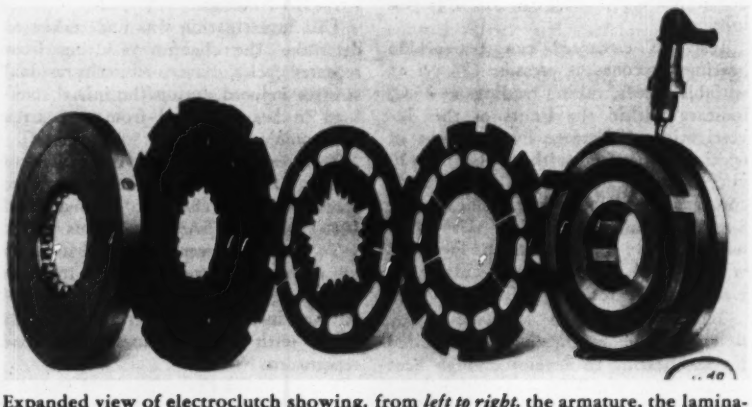
It is when these various mechanisms are tied together by some form of automatic control that we are faced with the design attempting to equal the sense of the human in the form of ability to feel, see, and judge when to make the adjustments.

The Electromagnetic Clutch, Its Operation, Application, and Control, by H. B. Stallings, I-T-E Circuit Breaker Co., Philadelphia, Pa. 1954 ASME Fall Meeting paper No. 54—F-9 (multilithographed; available to July 1, 1955).

The electroclutch described in this paper was developed on the Continent by ZF (manufacturers of gears and transmissions) to fill the need for a simple clutch operable under oil and which could be used for automatic clutching without any intermediate means such as hydraulic fluids, mechanical levers, or air cylinders.

Today this clutch is widely used for the following types of drives for either power or feeds or both:

1 Machine tools—lathes, automatic



Expanded view of electroclutch showing, from *left to right,* the armature, the lamination stack, a single inner lamination, a single outer lamination, and the clutch body with the imbedded clutch coil, the slip ring, and the brush for conducting current to the coil

copy lathes, automatic turret lathes, milling machines, gear-cutting machines, gear-hobbing machines, shears, large punch presses, boring mills, automatic precision-drilling machines, and the like.

2 Special machines such as textile and knitting machines.

3 Automatic transmission for buses and large trucks.

4 Reversing duty for ship propellers. Many other uses are being contemplated, such as overdrives for automobiles, fan drives, cranes, and hoists.

Elements of the electroclutch include the following: The armature, the lamination stack, a single inner lamination, a single outer lamination, and the clutch body with the imbedded clutch coil, the slip ring, and the brush for conducting current to the coil. Only one brush is used, as one coil lead is connected to the clutch body.

The magnetic flux present when the coil is energized causes a pull between the body and armature. The armature is forced against the body and, therefore, exerts a pressure or force compressing the lamination stack. The torque which the clutch can transmit is a function of the magnetic pull (compression force), the coefficient of friction between the mating surfaces in the lamination stack, and the number of mating surfaces in the stack.

As the magnetic force closing the clutch is present only between the magnet body and the armature, no external operating force is transmitted to the shafts or bearings. These parts, therefore, are unaffected by the closing force of the clutch.

Unlike other lamination-type clutches, the electroclutch is self-compensating for lamination wear, small as it is. This feature is of great value from a maintenance standpoint.

When steel laminations are pressed together they can transmit an appreciable torque even after the pressure is reduced or relieved. In order to make it possible for the clutch to disengage in a reasonable time, it is necessary to force the laminations apart after the magnetic force is removed by disconnecting the coil.

For this reason, one half of the laminations are wave-formed and act as springs to force the laminations apart. In closing the clutch, the magnetic pull must be greater than the spring tension in order to flatten the laminations and obtain the maximum torque. It is of interest to note that the opening spring force does not reduce the transmissible torque.

Performance Operator, by B. G. Bromberg, McDonnell Aircraft Corp., St. Louis, Mo. 1954 ASME Fall Meeting paper No. 54—F-6 (multilithographed; available to July 1, 1955).

THE performance operator is a concept developed by C. S. Draper and his associates in the Instrumentation Laboratory of Massachusetts Institute of Technology. Its usefulness in automatic-control theory has been proved by its successful application to the complete analysis of complex Naval fire-control systems and to the analysis of automatic flight control of aircraft and guided missiles.

The performance operator may be broadly defined as a concept designed to express in readily identifiable form the performance characteristics of an operating system. "Performance characteristics" of a component or a system are those characteristics of the component or system which alter its output with respect to its input or inputs.

In this paper the concept of the performance operator and a specialized notation suitable for closed-loop systems are presented.

The algebra of combining a group of dynamical components is developed.

Examples of first order, second order, and multidegree systems are developed to illustrate the application of the performance operator.

Finally, the performance operator of a generalized system is derived and is shown to be a function of the system parameters only and is independent of the type of excitation to the system.

Design of Power Spur-Gear Trains For Minimum Inertia, by T. A. Stoner and C. B. Sipek, Kearney and Trecker Corp., Milwaukee, Wis. 1954 ASME Fall Meeting paper No. 54—F-8 (multilithographed; available to July 1, 1955).

THE inertia of a gear train becomes an important consideration whenever rapid acceleration of a load is required. If the gear-train inertia is appreciable compared to the load inertia it is desirable to reduce it to a minimum in order to utilize motor torque fully.

In this paper methods of designing power spur-gear trains for minimum inertia and approximate minimum inertia employing equally stressed pinions are described.

The accuracy of the approximate-minimum-inertia method is shown.

Curves for this method are presented. The use of these curves for selecting an optimum number of gear meshes and for making a rapid estimate of gear-train inertia is explained.

A comparison of gear-train inertia is made between a gear train using equally stressed pinions and a gear train using pinions of identical size.

The Influence of Solid Particles in the Oil to Babbitt, Copper-Lead, and Aluminum Bearings, by H. G. Rylander, Assoc. Mem. ASME, and E. M. Wight, University of Texas, Austin, Texas. 1954 ASME Fall Meeting paper No. 54—F-11 (multilithographed; available to July 1, 1955).

THIS paper describes an experimental investigation of copper-lead and aluminum bearings operating with oil containing solid particles of molybdenum sulphide, red rouge, and corundum.

The following conclusions were reached in the paper:

1 Bearing and shaft surface finish are of prime importance. A mild abrasive, such as fine rouge, added to the oil will improve the bearing and shaft surfaces during operation. Under certain conditions, bearing-load capacity can be more than doubled by using small amounts of rouge in the oil.

2 The friction is virtually independent of roughness when the bearing operates in the region of film lubrication. A combination of an extremely smooth shaft and bearing may reduce friction slightly.

3 Molybdenum sulphide possesses good antiseizing properties. It does not lower coefficient of friction in the region of film lubrication. It was most effective on copper-lead with an increase in load capacity of 60 per cent.

4 Both copper-lead and aluminum bearings have very poor embedability characteristics as compared with babbitt. Friction values for aluminum and copper-lead were as much as $7\frac{1}{2}$ times those of babbitt when operating with small amounts of 22-micron corundum.

5 Aluminum bearings withstand metal-to-metal contact at high temperatures better than babbitt and copper-lead, which wipe the babbitt or lead into the oil grooves.

6 Very rapid wear may take place with small concentrations of hard sharp particles. The harder bearing materials are no improvements over babbitt as far as wear is concerned. Oil discoloration does not indicate the friction or wear to be expected.

7 Good filtration is much more important when using the harder bearing materials of aluminum and copper-lead than when using babbitt. Particles as small as 6 microns cause friction increases five times normal.

Applied Mechanics

The Anticlastic Curvature of a Strip With Lateral Thickness Variation, by Y. C. Fung and W. H. Wittrick, California Institute of Technology, Pasadena, Calif. 1954 West Coast Applied Mechanics Conference paper No. **54—APM-7** (in type; available to April 1, 1955; to be published in the *Journal of Applied Mechanics*).

THE large deflection equations of von Kármán have been extended to apply to plates of variable thickness with initial deviations of the middle surface from a plane. These are used to determine the distortion of the cross section of a strip with lateral thickness variation, when bent uniformly in the longitudinal direction.

Numerical calculations are made for the case of a strip whose cross section is of double-wedge shape. It is shown that when the longitudinal curvature becomes large the distortion of the cross section is quite different from that of a strip of uniform thickness.

Impulsive Response of Beams in the Elastic and Plastic Regions, by W. T. Thomson, Mem. ASME, University of California, Los Angeles, Calif. 1954 West Coast Applied Mechanics Conference paper No. **54—APM-5** (in type; available to April 1, 1955; to be published in the *Journal of Applied Mechanics*).

THE problem of the impulsive response of a beam in the elastic and plastic regions is discussed.

The beam in the plastic region is simulated by yield hinges where the moment reaches a constant yield value. Transition from the elastic to the plastic beam, including the satisfaction of the initial conditions imposed on the plastic beam, is accomplished automatically in terms of the normal mode solution of each.

A practical computing scheme making use of the electronic analog computer is described. Some elastic-plastic solutions obtained by the computer are presented.

Prediction and Evaluation of Sensitivity to Transient Accelerations, by M. Kornhauser, U. S. Naval Ordnance Laboratory, White Oak, Md. 1954 West Coast Applied Mechanics Conference paper No. **54—APM-3** (in type; available to April 1, 1955; to be published in the *Journal of Applied Mechanics*).

THE determination, presentation, and interpretation of inertia-sensitivity data are discussed with application to inertia devices and to shock-resistant structures. Theoretical analysis of the single-degree-of-freedom system for response to accelcration-time pulses, amplification factors, and inertia sensitivity are used as a basis for discussion of actual devices. Effects of deviations from the ideal mass-spring system are considered.

Practical use of sensitivity data is discussed with regard to the reliability of laboratory methods, the accuracy of field measurements, and variability of service conditions. Criteria are suggested for design of inertia mechanisms and design of structures for resistance to shock.

Boundary-Value Problems of the Thin-Walled Circular Cylinder, by N. J. Hoff, Mem. ASME, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1954 West Coast Applied Mechanics Conference paper No. **54—APM-4** (in type; available to April 1, 1955; to be published in the *Journal of Applied Mechanics*).

THE homogenous differential equations of Donnell's theory of thin cylindrical shells are integrated. Expressions are obtained in closed form for the displacements, membrane stresses, moments, and shear forces.

ASME Transactions for October, 1954

THE October, 1954, issue of the Transactions of the ASME (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

Technical Papers

Stability of Gas Flow in a Tube as Related to Vertical Annular Gas-Liquid Flow, by A. D. K. Laird.

Theoretical Calculation of the Equation of State and Transport Properties of Gases and Liquids, by R. B. Bird, J. O. Hirschfelder, and C. F. Curtiss. (53—A-87)

The Tabulation of Imperfect-Gas Properties for Air, Nitrogen, and Oxygen, by Newman A. Hall and Warren E. Ibele. (53—A-5)

Generalized *pvT* Properties of Gases by L. C. Nelson and E. F. Obert. (53—A-194)

Survey of Experimental Determinations of Heat Capacity of Ten Technically Important Gases, by Joseph F. Masi. (53—A-206)

Results of Service Test Program on Transition Welds Between Austenitic and Ferritic Steels at the Philip Sporn and Twin Branch Plants, by G. E. Lien, F. Eberle, and R. D. Wylie. (53—A-150)

Cyclic Heating Test of Main Steam Piping Materials and Welds at the Sewaren Generating Station, by H. Weisberg and H. M. Soldan. (53—A-151)

Stress-Rupture Properties of Some Chromium-Nickel Stainless-Steel Weld Deposits, by R. D. Wylie, C. L. Corey, and W. E. Leyda. (53—A-152)

Some 12 Per Cent Chromium Alloys for 1000 F to 1200 F Operation, by D. L. Newhouse, B. R. Seguin, and E. M. Lape. (53—A-168)

Effect of Certain Elements on the Graphitization of Steel, by R. J. Fiorentino, A. M. Hall, and J. H. Jackson. (53—A-153)

Dynamic Characteristics of Silicone Rubber, by G. W. Painter. (53—A-88)

Synthesis of the Four-Bar Mechanism When the Position of Two Members Is Prescribed, by B. W. Shaffer and I. Cochin. (53—A-144)

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Gas Turbine Power

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Railroad

54—F-1 Some Remarks on the Theory of Maintenance of Rolling Stock, by R. R. CRANE and F. B. BROWN

Comments on Papers

Including Letters From Readers on Miscellaneous Subjects

Simplified Drafting

Comment by J. C. Downing[1]

THE writer agrees with the author[2] that much time and labor can be saved in drafting by applying the basic principles he has outlined in his paper. The writer has had some experience along this line and knows how costs in producing drawings can be reduced greatly through simplified drafting techniques and also by employing the offset method of drawing reproduction such as the "multigraph" machine process.

We have been following this modern trend for over five years, enjoying a nice return on our initial investment and continued savings. At the same time, we have been able to turn out finished drawings, covering customer's special shape specifications, in a matter of minutes rather than hours, thereby greatly improving our customer-order service. It is rather difficult to evaluate such rapid service in terms of dollars and cents but it is an invaluable asset in these days of keen competition.

Control by Drafting Manual

However, the writer cannot fully agree with the author that simplified drafting practices have to be sold individually in the drafting room by supervision. The main idea or principle must first be sold to top management for their consent, then to supervision for administration, and a gradual program outlined and controlled by a drafting manual. The program must be gradual so that the factory, in general, and all people who use drawings directly or indirectly in their daily work are educated and geared to the new concept of working drawings. The drafting manual covers the individual draftsman in the techniques to be used so long as he is an employee of that company. There should be no resistance or "old-timer" individualist to hinder the program. Once the decision is made to adopt this modern process, conformity of thinking is absolutely necessary and universal acceptance obtained and maintained. Supervision has plenty to do along this line in teaching and preaching the advantages to offset old-method prejudicial thinking.

Control of Revisions

There is one phase of drafting practice which the author does not mention but which is believed to be as important as any of the chronological steps from the "gleam" in the designer's eye to the finished, inspected product. That phase is the control of revisions or changes made in working drawings. This applies to drawings made either to the old or new drafting practices. The writer has seen so many violations to the practice of keeping drawings honest as to changes that he wonders if some companies realize how much time and confusion result from slipshod revisions—revisions made without noting the nature of the change or without even a revision date.

Many times during the past few years the writer has had company draftsmen call to his attention changes in customer's drawings in dimensions or tolerances from previous issues without acknowledgment in the revision block. It is surprising when it is noted that these drawings are not from small concerns with limited personnel or facilities but from large "name" concerns—leaders in the automotive, electrical, and machine-tool fields. The only consolation for us is to reason that the drawings probably were made by embryo draftsmen whose work got by a complicated or weak control of checking and approval. Or, the new draftsman of the big-name organization caught on to his error and sneaked through a revision to circumvent the ire of his supervisor.

Quite often the engineering department and the original tracing are called upon to act as the judge in a case of controversy between purchase-order contracts placed on a certain date, between inspection departments, prices quoted on certain specifications, or in claim settlements. Add any one case up and it is possible to consume all the time and more which was saved in drafting the original simplified drawing when the end result is a claim on the debit side. All this can come about because a draftsman made a simple revision and did not think it important to note a revision date.

Drafting Is Communication

Drafting is a form of communication in engineering language and whether it is a complete artistic picture comparable to a longhand flowery letter or a simplified drawing comparable to a concise, telegraphic message or even a futuristic drawing comparable to shorthand, the original tracing or master document always must be honest and record all alterations or changes that are ever made to that communication. A message can be reversed by the addition or deletion of the word "not" to a verb and the whole concept of a drawing can be changed by the addition or deletion of an insignificant tolerance or material specification.

All drafting sections should realize the importance of controlling revision dates and it should be a paramount function. It is not only important to the parent company but equally important to all related industries. It should be written into the drafting-room code of ethics as violation may affect the engineering department's integrity and the company's reputation.

As the advertisements represent a company to the public and the products prove or disprove the advertised claims, so do the drawings represent a company to other companies and the drawings depict the thinking of the engineers and prove or disprove the reliability of the company.

Author's Closure

Mr. Downing's comments are very gratifying. We are pleased to have such hearty agreement with the basic need for simplification in our drafting practice.

It seems that Mr. Downing's concept of a Drafting Manual differs somewhat from ours. He refers to a "gradual program" for the adoption of simplified drafting and states that the program should be "outlined and controlled by a drafting manual." Evidently he is thinking of some type of instruction manual for the

[1] Supervising Engineer, Product Design, Product Engineering, Bonded Products and Grain Division, Carborundum Company, Niagara Falls, N. Y. Mem. ASME.

[2] "Simplified Drafting," by A. H. Rau, MECHANICAL ENGINEERING, June, 1954, vol. 76, pp. 491–496.

education of draftsmen and the users of drawings, which I heartily endorse. We also agree with the need for gradual adoption so that the process of education of both "makers" and "users" of drawings can be successfully accomplished. Naturally, we agree that drawing standards should be outlined in a Drafting Manual.

We have been unable to discover anything in the original paper to prompt Mr. Downing's long dissertation on the control of revisions; however, even here his comments are consistent with General Electric practice.

Any disagreement we may have with Mr. Downing's discussion of the paper would be largely based on terminology, not basic thinking.

A. H. Rau.[3]

Air Pollution

Comment by G. D. Clayton[4]

The author has presented a most interesting paper,[5] the subject of which should cause deep concern to all of us. He states that in London during a five-day period, smog was responsible for the death of at least four thousand people. This terrible episode caused more deaths than those attributed to cholera in the week of its highest mortality during the summer of 1866. Only during the influenza epidemic in 1917 were more deaths recorded for a similar period of time. It is important to note that the author records the fact that this is not the first smog episode in London where increased mortality was observed.

The people in London, however, are not alone in being subjected to lethal concentrations of air pollutants. Meuse Valley, Belgium, Donora, Pa., Poza Rica, Mexico, and Los Angeles, Calif., are other communities where similar occurrences have been reported. Unfortunately, it is safe to assume that other communities have experienced increased mortality during smog visitations which have not been recorded in scientific journals.

One of the interesting facts of this paper is that fog occurred in many parts of the country. Excluding London, an aggregate population of fourteen million showed no great increase in mortality. This same phenomenon was observed in the Donora investigation where fog, meteorological conditions, and air pollution were similar in surrounding communities. A study of these communities showed no material increase in mortality.

It is obvious that in those areas in England where fog was reported, atmospheric pollution also existed. It would be interesting to investigate whether the sulphur dioxide and total particulates reached the same concentrations in those areas where no increased mortality was observed versus the areas where increased mortality occurred.

To the astute, this paper raises many serious questions, the foremost being, "What can be done to protect the populace in our urban areas?" It assumes major importance to our national growth and welfare, as people have a right to expect to live in communities free from harmful effects of air pollutants and industry must have the proper environment in which to expand. Obviously, the first step is to obtain the facts on the chronic and acute effects of air pollutants upon the community. The procurement of these facts undoubtedly will result in the development of sound basic standards (maximum allowable concentrations). This is necessary before orderly progress can be made in the abatement of air pollutants. Maximum allowable concentrations pertaining to health, safety, economy, and vegetation, either for total contaminants, specific elements, compounds, or combination of compounds are unknown with the exception of concentrations of sulphur compounds in relation to the destruction of vegetation. This lack of basic information makes it difficult not only for the control officials but also industry and the community, to know exactly to what extent controls are necessary. In the light of this limited knowledge, caution must be exercised in requiring expensive equipment for the control of effluents emitted to the atmosphere. As more information is acquired on the influence of contaminants, the equipment now installed or proposed, later may be found to be inadequate for the protection of the community.

The primary objective of the Public Health Service in the field of air pollution, when funds become available, is to determine both the chronic and acute effects of air pollutants upon the health of the populace. However, industry should not depend solely upon the Public Health Service for this information. Industry should be willing to supply funds to well-qualified research institutions for research in this field. Thus the fundamental data can be made available in a shorter period of time with subsequent prevention of other disasters.

Once maximum allowable concentrations have been established, city planning commissions can utilize this information for approving new plants or expansion of existing facilities. This could be accomplished by determining first the existing levels of pollution in an area and obtaining potential aerial discharges of the proposed facilities. With this information a few calculations can be made to determine whether the new levels, if the plant were constructed, would exceed the maximum allowable concentrations. Thus the existing plants in the area would be protected from installing expensive control equipment.

The author's presentation shows the excellent scientific work the British have been accomplishing in the field of air pollution. This is exemplified by the fact that this is the first air-pollution episode where environmental data were being collected before, during, and after the disaster.

With the free interchange of information on air pollution between Great Britain and the United States, such as this paper, it will be possible to obtain, more rapidly, answers to this most complex problem.

Author's Closure

The author would like to endorse the concluding remarks of Mr. Clayton on the desirability of free interchange of information on air pollution between Great Britain and the United States. The many problems involved are complicated by the variety of pollutants and meteorological conditions in the affected areas. Having seen, smelled, and tested smogs in both countries, he is convinced that in some areas, e.g., Los Angeles and London, the main pollution problems may be materially different, while in others they have much in common. A full study of each and every occurrence would greatly assist the ultimate solution of these complex problems.

Mr. Clayton has suggested that it would be interesting to investigate whether there was any relationship between the distribution of pollution and increased mortality in different parts of the area affected by the London smog of December, 1952. In reply it can be said that a preliminary assessment has been made on the basis of the pollution concentration shown in Fig. 2 of the paper but no conclusive relationship with mortality has yet emerged. There are, of course, many factors which complicate the issue but the study is being continued.

E. T. Wilkins.[6]

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[3] Manager, Drafting, General Electric Company, Schenectady, N. Y.

[4] U. S. Public Health Service, Detroit, Mich.

[5] "Air Pollution in a London Smog," by E. T. Wilkins, Mechanical Engineering, May, 1954, vol. 76, pp. 426–428.

[6] Officer in Charge, Atmospheric Pollution Research, Fuel Research Station, Department of Scientific and Industrial Research, London, England.

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Columbia School of Engineering

A History of the School of Engineering, Columbia University, By James Kip Finch. Columbia University Press, New York, N. Y., 1954. Cloth, $6^1/_2 \times 9^3/_4$ in., illus., index, vii and 138 pp., $2.75.

Reviewed by Donald B. Prentice[1]

This story of a school is one volume of the Bicentennial History of Columbia University, written by a former professor and dean of the division which he describes. Not only is the book an interesting description of the birth, infancy, and young adulthood of a vigorous member of the Columbia family but at the same time, and almost by necessity, it is a record of the development of engineering education in the United States since the Civil War. The author is fully competent to discuss engineering education both at Columbia and nationally, having spent nearly all of a long professional life in the classrooms of his alma mater and on numerous committees of wider assignments in the engineering world.

As might be expected of a sound educator, Dean Finch believes that the heart of a school is its faculty; a majority of the pages in this history, therefore, are devoted to the careers and contributions of great and near-great teachers. Many of them will be recalled as personal friends, or at least nodding acquaintances, by almost any engineering educator, or engineer for that matter, who reads the book. Dean Finch has been frank in his appraisals of ability and, so far as this reviewer can judge, eminently fair. This reviewer, incidentally, has a more than normal interest in the School "of Mines" and later "of Engineering" for as a boy he frequently visited Camp Columbia whose buildings were insured through his grandfather of Litchfield, Conn. In this way, for instance, a youngster of maybe six or eight years was introduced to Professor Munroe and to Professor Lovell.

The School of Mines was a most important, perhaps the most important, undergraduate division of the developing university for a fairly long period and Dean Finch has found it necessary to present more than mere references to the growth of the inclusive organization in order to demonstrate the influence, at times domination, of this vigorous member. The volume will be read with pride by alumni of "mines and engineering" and should be read at least with respect by alumni of the "college."

Columbia's home has been moved from downtown to midtown to uptown New York. Engineering, as a school, began at 49th Street, moved to Morningside, and now is in the process of expanding into an "engineering center" of its own. The record of its ninety years is not one of continuous success in every respect. Dean Finch is very objective in describing the serious results, enrollmentwise, which followed the early introduction of the six-year curriculum. But whatever its size, whether larger or smaller than the "College," Columbia engineering earned and maintained a reputation for sound scholarship and rigorous standards. The proof lies in the success of its alumni, and the careers of many nationally known graduates are cited by Dean Finch as evidence.

While this "History" is of special interest, naturally, to those who have attended or taught at the "School," the philosophy of engineering education, the national trends, the interruptions and experiences of wartime programs, and the predictions of future growth, which are introduced by an author with a half-century of participation and keen observation in the field, make the book of value to many more than its Columbia readers.

[1] Director and Treasurer, The Scientific Research Society of America, New Haven, Conn. Fellow ASME.

Books Received in Library...

ASTM Standards on Gaseous Fuels. American Society for Testing Materials, Philadelphia, Pa., 1954. 176 pp., 9 × 6 in., paper. $2.50. All the test methods in the field are compiled in this pamphlet for convenient use. Methods are described for sampling natural, manufactured, and liquefied-petroleum gases; analysis of natural gas and carbureted water gas; determination of sulphur in petroleum products and liquefied-petroleum gases; and related methods. Five of the twelve tests included are new and the others have been revised.

Library Services

Engineering Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

Adhesive Bonding of Metals. By George Epstein. Reinhold Publishing Corporation, New York, N. Y., 1954. 218 pp., $6^3/_4 \times 4^1/_4$ in., bound. $2.95. The aim of this book is to give information sufficiently detailed to enable the engineer to determine the advisability of using adhesive bonding, to select the best adhesive, and to design the joint. It also discusses the chemistry and formulation of adhesives, factors affecting strength, and sandwich construction. A separate chapter covers elevated-temperature-resistant adhesives for metals.

Aerodynamics. Selected Topics in the Light of Their Historical Development. By Theodore von Kármán. Cornell University Press, Ithaca, N. Y., 1954. 203 pp., $9^1/_4 \times 6^1/_2$ in., bound. $4.75. Briefly summarizes fundamental aspects of progress in the field, particularly in the past fifty years. The contributions of individual scientists are discussed in nontechnical language in chapters on research before flight; the theories of lift, drag, and skin friction; supersonic aerodynamics; and stability and elasticity. The last chapter is a history of aerial propulsion from the propeller to the space rocket.

Canadian Trade Index, 1954. Canadian Manufacturers' Association, Inc., 67 Yonge Street, Toronto 1, Canada, 1954. 1126 pp., $10^1/_4 \times 6^3/_4$ in., bound. $7.50. Lists alphabetically over 10,000 manufacturers with addresses, branches, export representatives, trade-marks, and other information. There is also a section alphabetic by products and special sections on Canada's export and produce trade. French equivalents of products are included. A number of new firms are included in this edition and changes in names and addresses have been recorded.

Contribution a L'Étude de la Déformation Plastique. By Bernard Jaoul. France, Ministère de l'Air, Publications Scientifiques et Technique, Paris, France, 1954. 86 pp., $11^5/_8 \times 7^1/_8$ in., paper. 800 fr. This contribution to the study of plastic deformation in metals discusses the "transition point" between two major zones of plasticity exhibited by aluminum and aluminum alloys under tension. It includes a detailed examination and interpretation of curves plotted from tension tests

under varied conditions of composition and physical treatment.

DIESEL LOCOMOTIVES. By John Draney. American Technical Society, Chicago, Ill., 1954. 344 pp., $8^1/_2 \times 5^5/_8$ in., bound. $4.85. Basic information is provided for the training of personnel engaged in building, operating, and servicing diesel-electric locomotives. Fundamentals of engine cycles and of combustion are treated briefly and separate chapters give details of engine parts and accessories. The latter half of the book discusses electrical fundamentals. Material included is a revision of a 1943 text issued in two parts.

ELEKTRONISCHE UND MAGNETISCHE STEUERUNGEN UND REGELUNGEN IN DER ANTRIEBSTECHNIK. Edited by Wissenschaftlichen Ausschuss des Verbandes Deutscher Elektrotechniker. VDE-Verlag, Berlin, 1953. 122 pp., $9^1/_2 \times 7$ in., bound. 6 DM. A symposium of seven papers on electronic and magnetic control and regulation of drives. The several papers deal with fundamental principles, with the selection of the proper equipment, and with various applications to machine-tool drives, process machinery, and other mechanical and electrical devices.

ÉTUDE ET TRACÉ DES ÉCOULEMENTS PERMANENTS EN CANAUX ET RIVIÈRES. By R. Silber. Dunod, Paris, France, 1954. 192 pp., $9^1/_2 \times 6^1/_4$ in., paper. 1800 fr. A detailed study of the characteristics of flow in open channels, graphically illustrated by curves representing a wide variety of profiles and flow conditions.

FLACHENTRAGWERKE. By Karl Girkmann. Springer-Verlag, Vienna, Austria, third edition, 1954. 558 pp., $9^1/_4 \times 6^1/_2$ in., bound. $15.80. A detailed treatment of the elastostatics of plate structures, which discusses the important problems involved in the calculations of stresses and deflections in plates, shells, and prismatic structures. For practical use the analytical solution of a wide range of such problems is carried out with particular attention to the underlying principles of these solutions.

FLUID MECHANICS. WITH ENGINEERING APPLICATIONS. By R. L. Daugherty and A. C. Ingersoll. McGraw-Hill Book Company, Inc., New York, N. Y., fifth edition, 1954. 472 pp., $9^3/_8 \times 6^3/_8$ in., bound. $7. The changed title of this standard text previously issued as "Hydraulics," reflects the generalization of the subject matter so as to apply to all fluids, including vapors and gases. Topics considered include fundamental concepts, fluid statics, kinematics, and dynamics, and applications in measurement, flow through pipes, flow of water in open channels, hydraulic machinery, etc.

HANDBOOK OF HYDRAULICS. By Horace Williams King, revised by Ernest F. Brater. McGraw-Hill Book Company, Inc., New York, N. Y., fourth edition, 1954. Various paging, $7^3/_4 \times 5^1/_4$ in., bound. $8. Provides in compact form tables and reference data needed for the solution of hydraulic problems. Pipe formulas no longer widely used have been omitted from this edition and a discussion of viscosity has been added. Among the numerous other changes are new material on flow through orifices and culverts, flow over submerged weirs, and rearrangement of the section on nonuniform flow in open channels.

HANDBUCH DER MASCHINEN-INDUSTRIE, 1953. Verein Deutscher Maschinenbau-Anstalten, Frankfurt (available in U. S. from Business Publications, P.O. Box 154, Mamaroneck, N. Y.) 1953. 873 pp., $10^1/_2 \times 7^1/_2$ in., bound. $12. A directory of over 3000 West-German machine-tool firms—members of the VDMA (German Machine-Tool Association)—and their products. Complete alphabetical, geographical, and classified listings are provided. Detailed information about the companies appears in the geographical listing.

HEAT TRANSMISSION. By William H. McAdams. McGraw-Hill Book Company, Inc., New York, N. Y., third edition, 1954. 532 pp., $9^1/_4 \times 6^1/_4$ in., bound. $8.50. Treats the subject in three parts—conduction, radiation, and convection—with coverage extended to include important data published through 1952. Much of the book has been rewritten, and there are new chapters on natural convection, high-velocity flow, and rarefied gases. Appendexes include data on thermal conductivities, specific heats, etc., and there is a bibliography.

HYDRO POWER ENGINEERING. By James J. Doland. Ronald Press Company, New York, N. Y., 1954. 209 pp., $9^1/_4 \times 6^1/_4$ in., bound. $7.50. This textbook emphasizes the practical approach to the design and preparation of plans for hydroelectric power installations. Taken up in order are fundamentals, practical routine for selecting runners, design of water passages, proper number of units, and the power station and its appurtenances. There are also separate chapters on costs and on combined hydro and steam plants.

INTRODUCTION TO MATHEMATICAL STATISTICS. By Paul G. Hoel. John Wiley and Sons, Inc., New York, N. Y., second edition, 1954. 331 pp., $9^1/_4 \times 6$ in., bound. $5. Some of the important topics covered are sampling inspection, design of experiments, testing of statistical hypotheses, analysis of variance, sequential analysis, and nonparametric methods of analysis. A chapter on probability has been added to this edition, changes in the order of presentation place greater emphasis on theory, and a large number of practical problems have been added.

MÉMOIRES SUR LA MECÁNIQUE DES FLUIDES. By Dimitri P. Riabouchinsky. France, Ministère de l'Air, Publications Scientifiques et Techniques, Paris, France, 1954. 443 pp., $9^1/_2 \times 6^1/_4$ in., paper. 3000 fr. A symposium of thirty-nine papers in the field of fluid mechanics covering a wide range of subject matter: classical fluid mechanics; turbulent flow; hydraulic analogy in aerodynamics; gas dynamics; cavity flow; flow measurement; weir wave suppressor; lubrication phenomena; the use of a vertical air jet as a windscreen; etc. There are two biographical sketches of Dimitri Riabouchinsky, in whose honor the papers were written, and a bibliography of his publications.

METAL CUTTING TOOL HANDBOOK. Metal Cutting Tool Institute, New York, N. Y., new edition, 1954. 689 pp., $9^3/_8 \times 6^1/_4$ in., bound. $7.50. Separate sections provide the latest data on twist drills, reamers, counterbores, taps, dies, milling cutters, hobs, gear-shaper cutters, gear-shaving cutters, and broaches; giving information on design, applications, maintenance, and dimensions and tolerances of standard-size tools. Tables of engineering data are also provided. About forty per cent of the material in this edition is new and a number of revisions have been made in the original text.

PHYSICS OF EXPERIMENTAL METHOD. By H. J. J. Braddick. John Wiley & Sons, Inc., New York, N. Y., 1954. 404 pp., $8^3/_4 \times 5^1/_2$ in., bound. $7. Attention is directed to the branches of physics which are important in planning and executing experiments in physical research, with emphasis on principles and presently available techniques. Material is included on errors and the treatment of experimental results, on the design of apparatus from the mechanical standpoint, on materials used in apparatus design, and on instruments and their uses in a wide variety of fields.

PRACTICAL GEAR DESIGN. By Darle W. Dudley. McGraw-Hill Book Company, Inc., New York, N. Y., first edition, 1954. 335 pp., $9^3/_8 \times 6^3/_8$ in., bound. $7. This is a practical manual on the design and manufacture of gears and causes of gear failure written for the general engineer and technician rather than the specialist. There are chapters on materials and tools, and special problems such as high-speed gearing are discussed. References are listed at the end of some chapters.

REVIEW OF METAL LITERATURE, Volume 10, 1953. Edited by Marjorie R. Hyslop. American Society for Metals, Cleveland, Ohio, 1954. 711 pp., $9^1/_4 \times 6^1/_4$ in., bound. $15. This is the tenth annual volume of one of the most important bibliographies in the field. It is a classified list of articles and papers from English and foreign-language periodicals and books with author and subject indexes. Brief abstracts indicate the scope and content of articles listed.

TECHNISCHE HYDRO- UND AEROMECHANIK. By Walther Kaufmann. Springer-Verlag, Berlin, Germany, 1954. 352 pp., 10 × 7 in., bound. 36 DM. A textbook for engineering and physics students written to replace the author's two-volume, "Applied Hydromechanics." There are three main sections: properties of liquids and gases; equilibrium, covering hydro- and aerostatics; motion of fluids, covering one, two, and three-dimensional flow and the fundamentals of the dynamics of compressible fluids (gas dynamics).

TIMESTUDY FOR COST CONTROL. By Phil Carroll. McGraw-Hill Book Company, Inc., New York, N. Y., third edition, 1954. 301 pp., $9^1/_4 \times 6^1/_4$ in., bound. $5. This is a practical manual for engineers or executives interested in installing a system of time study in the medium or small-sized plant. Applications, advantages, methods of measurement, and control of cost are discussed from the point of view of the standard-data method. There is new material on basic motion-time study, predetermined time standards, and other subjects.

WHAT EVERY ENGINEER SHOULD KNOW ABOUT RUBBER. By W. J. S. Naunton. British Rubber Development Board, London, England (available in U. S. from Natural Rubber Bureau, 1631 K Street, N. W., Washington 6, D. C.), 1954. 128 pp., $8^3/_4 \times 5^3/_4$ in., bound. $0.50. Discusses briefly the sources, manufacture, properties, and testing of natural rubber and, at greater length, its engineering applications. Among the latter are antivibration systems, sound insulation, flexible couplings, belts, seals, and other uses.

WIND-TUNNEL TESTING. By Alan Pope. John Wiley & Sons, Inc., New York, N. Y., second edition, 1954. 511 pp., $8^5/_8 \times 5^5/_8$ in., bound. $8.50. New material is included on nearsonic, transonic, supersonic, and hypersonic velocities, on the testing of helicopter rotors, and on nonaeronautical uses of the wind tunnel. Chapters on design, testing, use, and other aspects of the subject have been revised in the light of new knowledge and new techniques. References are listed after each chapter.

ASME NEWS

With Notes on the Engineering Profession

1954 ASME Annual Meeting to Highlight Influence of Science and Engineering on Modern Civilization

Technical Program Rounded Out by Inspection Trips and Social Events. Headquarters: Hotel Statler, New York, N. Y., Nov. 28—Dec. 3, 1954.

THE thousands of mechanical engineers from all over the United States and abroad who will be meeting in New York, N. Y., at the Hotel Statler from Nov. 28–Dec. 3, for the 1954 Annual Meeting of The American Society of Mechanical Engineers, will be richly rewarded. The technical program will be presented in more than 125 sessions, supplemented by panel discussions and symposiums.

The record number of technical sessions on the program reflects the increasing areas of engineering knowledge and endeavor being covered at ASME Annual Meetings. Each year more papers are scheduled and more sessions arranged, making evident the increasing interest of mechanical engineers in presenting their ideas before a discerning engineering audience and in having new developments and methods in ever-broadening horizons critically inspected and discussed by their fellows in the profession.

Several significant symposiums and panels will take up a vast variety of topics. The Hon. T. C. Desmond, Senator, New York State, will deliver the Roy V. Wright lecture. There will be college reunions and inspection trips; social events, where old friendships will be renewed, or new friends be made. Divisional luncheons, dinners, and the annual banquet will offer the guest an opportunity of hearing addresses by leaders in the Society and the engineering profession.

The technical program was published on pages 854–860 of the October issue of MECHANICAL ENGINEERING. Members are urged to consult the program as a guide in deciding which of the technical sessions, luncheons, and dinners will be of utmost interest to them. Some of the high lights of the Annual-Meeting program follow.

Technical Sessions

The program of technical sessions as presented under the auspices of the Professional Divisions of the Society is composed of panel discussions which will be devoted to such a variety of subjects as turboprop versus turbojets, training the engineer—whose job is it? or the general Technical Committee meeting on turbocharging of two-cycle internal-combustion engines. The sampling of symposiums being arranged for the program includes accreditation procedures and the professional responsibility of mechanical engineers; woodworking as a hobby for engineers; and economics of heat-exchanger design and operation.

Whether a Professional Division requires but one session or several sessions to present its program, it is certain that the papers will engender lively discussion when contributions covering the latest developments and news innovations are revealed in Applied Mechanics, Aviation, Materials Handling, Fuels, Hydraulics, Petroleum, Lubrication, Railroad, Fluid Meters, Education, Management, Boiler-Feedwater Studies, Mechanical Pressure Elements, Power, Corrosion and Deposits From Combustion Gases, Air-Pollution Controls, Process Industries, Textile Engineering, Rubber and Plastics, Metal Processing, ASME Research Activity, and Boiler Code.

Registration Schedule

Sun., Nov. 28	2:00 p.m. to 5:00 p.m.
Mon., Nov. 29	8:00 a.m. to 8:00 p.m.
Tues., Nov. 30	8:00 a.m. to 8:00 p.m.
Wed., Dec. 1	8:00 a.m. to 4:00 p.m.
Thurs., Dec. 2	8:00 a.m. to 8:00 p.m.
Fri., Dec. 3	8:00 a.m. to 3:00 p.m.

Fees for Nonmembers

A registration fee of $5 will be charged nonmembers attending the 1954 Annual Meeting of The American Society of Mechanical Engineers. The fee for student nonmembers will be $1.

The following nonmembers will be exempt from the payment of the registration fee:

Immediate family of a member (any grade)

Authors listed in the program or their appointed representatives

Invited discussers

Session chairmen and vice-chairmen

Committeemen required to attend a meeting of their committee

Session aides

Members of the Woman's Auxiliary to the ASME

Members of The Engineering Institute of Canada

Members of societies listed in the program

Distinguished guests invited by the President or Secretary of the Society

American Rocket Society

The American Rocket Society, an affiliate of ASME, will hold its annual meeting in conjunction with the ASME Annual Meeting. The three-day program of ARS, America's leading professional group in the rocket industry, is made up of sessions on low-temperature components and combustion; participation in joint societies' contributions in an introduction to the thermal problems of turbojet engines for supersonic propulsion; testing and design; discussions on the thermal barrier—effect on equipment and accessories; rockets, space flight, and a report on thermal barrier—effects on aircraft structures. The ARS Honors Night Dinner, as usual, is expected to attract a large attendance.

Other societies joining ASME in the formulation of the largest Annual Meeting Program of the Society's history include IAS, SAE, NSIA, and TAG.

Social Events

The outstanding event of the Annual Meeting is the Banquet. The speaker at this auspicious occasion will be Dr. John R. Dunning, dean of engineering, Columbia University. There will be a tea dance; a number of dinners of note, including: Wood Industries, Hy-

draulic Old Timers', and Applied Mechanics. Several luncheons which will certainly attract large audiences are the President's Luncheon, the always popular Honors Luncheon, and Fuels Luncheon with The Hon. D. B. Barnard, Deputy Assistant Secretary of Defense for Research and Development, Washington, D. C., whose topic of discussion will" be "Evolving Patterns in Fuels and Energy; the Nuclear-Energy Luncheon; the Heat-Transfer Luncheon, with Craig Taylor of the University of California, speaking on the Applications of Heat-Transfer Analysis to the Human Body; the Members and Students Luncheon; and the Textile Engineering Luncheon.

Aviation

The role of turboprop and turbojet transports in air cargo and air logistics will be one of the major topics of discussion at the Annual Meeting. L. R. Hackney of Transport Air Group, Inc., who is chairman of the Society's "Air-Cargo Days" program, said that this meeting would cover the economics of possible future transport airplanes and a panel discussion of turboprop versus turbojets with members from the leading airplane-manufacturing companies, such as Boeing, Allison, Convair, CAA, and G-E's Aircraft Gas Turbine Division making up the panel.

Nuclear Energy and Industrial Noise

Safety considerations in the operation of nuclear-power reactors and industrial noise as it concerns the mechanical engineer comprise two interesting and important sessions to be held November 30, arranged by the Safety Division. The morning session will present four papers by leading authorities on the subject of nuclear-energy safety, with Merril Eisenbud, director, Health and Safety Laboratory of the U. S. Atomic Energy Commission as chairman. The afternoon session on industrial noise consists of three papers touching on economics, what noise is, and how to control it. M. J. Pitre, Fidelity & Casualty Company of New York, will serve as chairman.

Woodworking as a Hobby for Engineers

That engineers need a hobby and that woodworking in a home workshop is the ideal hobby for them will be the central thought at the annual session of the Wood Industry Division on the evening of November 29. This is a distinct departure from the conventional technical program and bids fair to develop the idea of an avocation that engineers should enjoy, in their leisure time, if any.

Obviously, the theme expresses a much-needed antidote for the intense mental concentration that most engineers are obliged to give to their profession. A hobby, such as woodworking, will relieve mental strains, will provide an absorbing interest, and on occasion may add to meager incomes.

The symposium will be headed by C. R. Nichols, past-chairman of the Division, assisted by Ray DuBrucq, a prominent manufacturer of woodworking machinery; John Fenchen, whose side line in home shopwork is well recognized in the metropolitan area; and T. D. Perry, the veteran of the Wood Industry Division activities, who is not only a wood hobbiest, but is also an ardent philatelist.

This new approach to balancing the strenuousness of engineering with an engrossing hobby to achieve a broader human development will be watched with great interest by all engineers.

Power Show

A series of special events is being planned in conjunction with the 21st National Exposition of Power and Mechanical Engineering at Philadelphia, Pa., December 2 to 7. On the program will be papers and discussions of interest to visiting engineers attending the 1954 Annual Meeting, Nov. 28–Dec. 3, at the Statler Hotel, in New York, N. Y., of The American Society of Mechanical Engineers, under whose auspices the exposition in Philadelphia's Commercial Museum will be held.

Fairless Works Inspection

Of particular interest to ASME members will be plans now being developed for an inspection trip from the Annual Meeting in New York to the Power Show via the Fairless Works of U. S. Steel Corporation on Friday, December 3. On Monday, December 6, there will be a joint dinner and meeting of the Philadelphia Section of the ASME and the American Society of Civil Engineers.

Symposium on Automation

Another timely event will be an all-day symposium on Automation to be held by the Instrument Society of America, December 3, covering such topics as "Trends," "New Problems Created by Automation," "Automatic Intelligence Gathering Systems," and an analysis of "The Engineering Control Loop." Another event already announced is a dinner meeting of the Plant Engineers Club of Greater Philadelphia, to be held at the show Thursday, December 2.

Women's Program

The Women's Program, arranged by the Woman's Auxiliary to the ASME is—as it is every year—simply brimming over with wonderful things to do, and the whole town to do them in. For example, the festivities start with a social hour on Sunday at the Town Hall Club; Monday wakes up with a coffee hour, flies through the President's Luncheon, the tea dance, and closes on a night-club tour, which includes the Latin Quarter and Chateau Madrid. On Tuesday, in the morning is the National Board Breakfast and Meeting, followed by a tour of Dan Cooper, Inc., the interior-decorator establishment in Rockefeller Plaza, and then the Annual Luncheon and Fashion Show, "Preview of 1955," under the direction of Countess Denise Dolfin, at the Cotillion Room of the Hotel Pierre. At the evening coffee hour colored slides on Arabia will be shown and narrated by Karl Twitchell who recently returned from the Middle East. Wednesday will be no less full than any other day. In the morning the Annual Meeting of the Woman's Auxiliary to the ASME will be held. As for luncheon—here is the time for decision—either the Stork Club and a lingerie show by Vanity Fair, or luncheon and a tour of the Metropolitan Museum of Art . . . that is a two-headed penny for sure. The evening is very plush—the Annual Banquet, the President's Reception, and dancing. The closing day winds up with a demonstration of tactile painting and a talk on hobbies—"Stay Alive as Long as You Live," by Helen J. McRae, luncheon at the New York Times Restaurant, and a tour of *The New York Times*. Try that and you'll know you've had a busy day, a busy week, but it will be worth it, because sore feet and all, you will have had a fine time.

Official Notice

ASME Business Meeting

THE annual business meeting of the members of The American Society of Mechanical Engineers will be held on Monday, November 29, 1954, at 4:45 p.m., at the Hotel Statler, New York, N. Y., as a part of the Annual Meeting of the Society.

Members are urged to attend.

New ASME Officers Elected by Letter Ballot

AS REPORTED by the tellers of election, 1955 officers, W. A. Shoudy, L. N. Rowley, Jr., and C. A. Hescheles, letter ballots received from members of The American Society of Mechanical Engineers were counted on Sept. 28, 1954. The total number of ballots cast was 12,657; of these 169 were thrown out as defective. In addition, 34 votes were cast for 32 individuals.

	Votes for	*Votes against*
For President		
David W. R. Morgan	12,444	44
For Regional Vice-Presidents —serve two years		
William Henry Byrne	12,452	36
James Bernard Jones	12,467	21
Ben George Elliott	12,468	20
Clifford H. Shumaker	12,466	22
For Directors at Large—serve four years		
George Andrew Hawkins	12,474	14
Harold C. R. Carlson	12,463	25
For Director at Large—serve one year		
Louis F. Polk	12,468	20

The new officers will be introduced and installed in office during the 1954 Annual Meeting of the Society to be held at the Hotel Statler, Nov. 28–Dec. 3, 1954.

Biographical sketches of the newly elected officers were published in the August issue of MECHANICAL ENGINEERING, pages 699–702.

ASME Presidential Nominee David W. R. Morgan, *center*, gets a few pointers from ASME President Lewis K. Sillcox, *left*, and Past-President Alex D. Bailey, *right*, during President's Luncheon. In his address, President Sillcox saluted the men who built the great industrial empire in Milwaukee in his talk, "Champions Are Not Complacent."

Shown at the Banquet are, *left to right:* President Sillcox; Melvin J. Evans, the principal speaker; William J. Grede, toastmaster, and E. C. Koerper, general chairman of the 1954 ASME Fall Meeting. Mr. Evans said that until the engineer also becomes a human engineer, he cannot hope to reach the ultimate in his profession.

Milwaukee Section Plays Host to 1954 ASME Fall Meeting

Technical sessions, inspection trips, and social events spark up an excellent meeting program

With the highly industrialized and friendly atmosphere of Milwaukee serving as a pleasant background, some 1000 members and guests convened at the Hotel Schroeder, September 7–10, for the 1954 Fall Meeting of The American Society of Mechanical Engineers. The meeting also commemorated the 50th Anniversary of the ASME Milwaukee Section which played host to the attendees.

The main technical program consisted of 26 sessions at which more than 60 papers were presented. In addition, other special events included the following: A Golden Anniversary Gayeties Party at the Engineers' Society of Milwaukee Building on Tuesday evening which was designed to meet and introduce out-of-town members and guests to the Milwaukee Section; a "Gemütlichkeit" Party on Wednesday evening at the Blatz Brewing Company, featuring entertainment, refreshments, and smorgasbörd; the Presidents' Luncheon and the banquet on Thursday; inspection tours through four Milwaukee facilities; and a special program for the women arranged by the Milwaukee ASME Ladies Auxiliary.

President's Luncheon

Speaking at the President's Luncheon on Thursday, Lewis K. Sillcox, President of ASME, denounced those who oppose freedom of inquiry and praised "the fellow in the middle, attacked by the dogmas of all extremes, but still willing, ready, and anxious to fight for his own independence of thought and action and the divine right to change his mind for good cause."

Dr. Sillcox said: "Where is today's attack on learning and independent thought coming from? It does not originate in the know-nothing ranks of society, and it certainly does not come from the workingman's sector and the unions. The attack on learning seems to emerge from a group of people in American life whom we might describe as fearful, those who are afraid of progress, those who dislike change and oppose novelty."

Dr. Sillcox saluted "the men who built the great industrial empire in Milwaukee."

"The bringing together of a group of ordinary men," he said, "can lead to nothing more than an integration of routine ideas, and this was not the way in which Milwaukee was built up. Its leadership comprised champions who were not complacent."

As part of the program, Milwaukee's Mayor Frank Zeidler extended the city's welcome to the ASME. He pointed out that Milwaukee was truly one of the great mechanical-engineering cities in the United States by citing numerous industries in and around Milwaukee. He also stressed local community activity and urged greater work in civic affairs by engineers.

Alex D. Bailey, past-president and Fellow ASME, vice-president, Commonwealth Edison Company, retired, presided over the luncheon.

Human Engineering Discussed at Banquet

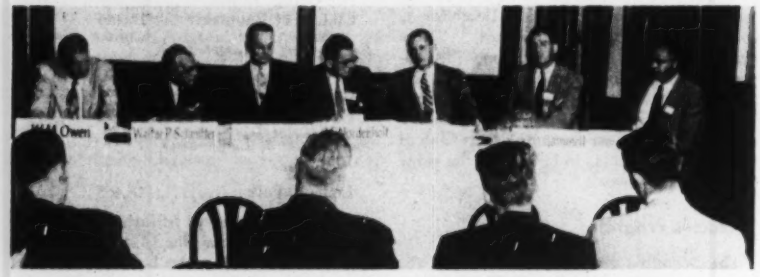
Melvin J. Evans, principal speaker at the banquet on Thursday evening, declared that American industry can profit greatly by applying the principles of "human engineering."

Mr. Evans is president of Melvin J. Evans Company, Chicago, Ill., and founder of the Democracy-in-Action (DIA) movement for industrial leadership.

He described the DIA formulas as leading to growth through development of character, development of positive attitudes, direction of energy, and acquisition of knowledge.

"We conserve on metals and other physical assets," he said, "but are very careless about our most precious possessions—the lives of our key people. As a result, a big percentage of our most capable men die before they are fifty."

Democracy in Action, Inc., a nonprofit organization, was conceived almost 20 years ago at the University of Wisconsin. Mr. Evans, an engineering graduate of the school,



Company training programs came in for a fair share of discussion during the panel on "Developing the Young Engineer," at a joint Machine Design, Junior, and Education session. *Left to right* are: W. M. Owen, W. P. Schmitter, J. E. Mulheim, G. F. Nordenholt as moderator, G. E. Moore, John Gammell, and G. F. Habach.

approached the president and the dean of the College of Engineering with a plan for "a super system to discover and develop leadership."

A group of volunteer students was brought together. Meetings were held weekly for five years. Out of these meetings grew a set of principles that have been adopted by business firms across the country.

Among the outstanding activities of the organization are the annual spring and fall Green Lake Conferences in Wisconsin, which attract hundreds of businessmen from the United States and Canada. Purpose of the conferences is to provide a climax for local group meetings at which participants rate one another on 20 characteristics of leadership and note each other's progress in improving those characteristics from time to time.

Mr. Evans told the audience that "until the engineer also becomes a human engineer, he cannot hope to reach the ultimate in his profession."

Ben G. Elliott, vice-president of Region VI, gave an official word of welcome to ASME in behalf of the Milwaukee Section, the six other sections, and 29 student branches of the region.

Also on the banquet program the following ASME presentations were made: Fellow Memberships to Curt G. Joa, president, Curt G. Joa, Inc., Sheboygan Falls, Wis.; Walter C. Lindemann, consulting engineer, Milwaukee, Wis.; James Frank Roberts, vice-president and director of engineering, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.; and a 50-year membership to Kenneth Lockett, Dixon, Ill.

William J. Grede, president, Grede Foundries, Milwaukee, Wis., presided.

Technical Program High Lights

Here, in brief, are some of the high lights from the ASME Fall Meeting technical program which included more than 60 papers:

At a Machine Design and Production Engineering session it was questioned whether it is economically advisable to attempt to replace the many skills of the human operator by mechanisms. Beyond a certain point of automaticity, the paper warned, the objectives can be gained only at the expense of added complications which may not be worth the cost. In another paper it was pointed out that the successful use of the electromagnetic clutch in 40,000 installations within a comparatively short time on industrial machines, buses, trucks, and reversing duty for ship propellers indicates the probability of a rapid widening of application, including overdrives for automobiles.

Shown at a joint Machine Design-Lubrication Activity Session are, *left to right:* F. Freundenstein, E. M. Wight, and H. G. Rylander, who gave the technical papers, and Colin Carmichael and T. A. Wetzel, chairman and vice-chairman of the session, respectively

In Materials Handling, it was learned that improved types of conveyer belts "made to order" for specific jobs are answering industry's growing demand for economical transportation of mass materials. New resilient synthetic fibers, while less bulky, result in stronger-woven fabrics that make belts more resistant to impact shock. Belts using high-tensile-strength steel cables now can be designed to operate at tensions as great as 3000 lb per in. of belt width, it was reported.

The efficiencies that are thermodynamically obtainable from a steam-power cycle by utilizing throttle pressures exceeding the critical pressure of steam were dealt with in a Power paper. In another presentation it was reported that no satisfactory nonflammable lubricant for steam turbines has yet been found. Specifications and other requirements for an acceptable nonflammable lubricant were proposed and several were named that would probably be satisfactory on the basis of nonflammability alone. These included perfluorinated hydrocarbons, tricresyl, phosphate, tetradichlorodiphenyl, and perhaps polymethyl phenylsiloxous and water-based fluids.

The results of intensive studies on forced-convection boiling and pressure drops, as part of a research project to determine heat-transfer rates through a bulk of water tubes at high Reynolds numbers, were presented at a Heat Transfer session. Forced-convection, nucleate-boiling heat transfer is currently receiving attention for application to water-cooled nuclear reactors for power, where high-heat fluxes are essential.

Obsolete hydroelectric plants or potential water-power sites can be converted into profitable investments by means of a number of practical modifications that will reduce their original cost without sacrificing reliability or long life, it was reported at a Hydraulics session.

Individual study is necessary for each hydroelectric project, the paper said. In various instances it has been found that improvements have been made by lowering speed or simplifying the hydraulic turbine. Rubber seals have been installed above and below the wicket gates and at the contact line between gates instead of a butterfly valve for reducing gate leakage when the turbine is shut down. Lubrication of the turbine bearing has been simplified. Simplification of the wicket gate and control mechanism has also been successful. Wicket gates may be eliminated entirely by providing only fixed stay vanes to

Overspeed protection of reheat turbine-generators is discussed by M. A. Eggenberger, *right*, of General Electric Company. Seated are: E. C. Bailey, *left*, and R. C. Allen, *center*, vice-chairman and chairman of the session, respectively.

R. L. Goetzenberger of Minneapolis-Honeywell Regulator Company, discusses M. H. Trytten's paper on "Engineering Education in Russia." Seated are, *left to right:* A. B. Bronwell, J. G. Van Vleet, and T. A. Marshall, Jr.

direct the water to a propeller or to a Francis-type runner.

Controversy over the effects of grinding upon the service life of ground metal parts can be traced to differences in grinding methods, it was reported at a Metal Processing-Production Engineering session. Unquestionably, abusive grinding can damage a surface, it was pointed out, but that is not sufficient reason for foregoing efficient stock removal, fine finishes, and dimensional accuracy which good grinding practice affords. Although it has been found by fatigue tests that the endurance limit of ball-bearing steel is reduced 20 to 25 per cent by severe grinding, gentle grinding gives the same endurance limit as the best-recognized methods of preparing fatigue specimens. It is thus apparent that the grinding conditions are extremely important in determining both the appearance and the serviceability of ground parts.

The advantages of shop-assembled steam-generating plants in varied types of installations were outlined during a Symposium on Package-Type Industrial Boilers. The chief benefit of the units, which range from 5000 to 35,000 lb of steam per hr at 250 psi pressure, has been ease of installation. The use of flame-failure devices and completely automatic control have provided further benefits in increased safety, efficiency, and ease of operation, it was stated.

That America is rapidly falling behind Russia in the race to produce engineers was the warning sounded during an Education-Engineering Manpower Commission of EJC session. According to this paper, the total number of trained engineers in Russia today is closely comparable to the number in the United States. To accomplish this, the Russians have increased the number of engineering graduates from 29,000 in 1948 to more than 50,000 in 1954. In contrast, the United States graduated only 19,000 engineers in 1954.

The results of acceptance and operational tests of a 4250-hp coal-burning gas-turbine power plant were presented at a Gas Turbine Power session. The paper dealt with the preliminary operation and acceptance tests which were run on oil and the two coal-burning test programs.

Other subjects covered by the technical papers included fuels, metals engineering, lubrication, management, railroads, a symposium on reheat-turbine protection, and panel discussions on developing the young engineer, what does the production engineer expect from new machine tools, and how can the production engineer apply the results of metal-cutting research.

Digests of many of the available Fall Meeting papers may be found in this month's ASME Technical Digest.

Plant Trips

One of America's greatest industrial cities, Milwaukee, leads the nation and the world in the production of many products. Milwaukee is second to none in the manufacture of tractors, diesel and gasoline engines, padlocks, wheelbarrows, motorcycles, and outboard motors. It produces more hosiery, leather gloves and mittens, and tin and enamelware than any other city in the United States. Other important products include equipment for flour mills and sawmills, workshoes, turbines, fuel-oil pipe, and road-building equipment. In the line of food Milwaukee rates as one of the largest veal-packing centers and as the greatest barley market. Four of the country's largest breweries are located in Milwaukee.

To provide a sample view of the diversified industry in this area, several inspection trips were arranged. On Thursday morning a trip through the Chain Belt Company was scheduled. In this modern plant, guests saw equipment for the manufacture of chains, bulk-handling equipment, conveyers, and construction equipment. A second trip was arranged through the West Allis Works of the Allis-Chalmers Manufacturing Company, a world leader in the manufacture of heavy machinery and tractors. Of special interest was the turbine test floor and 96-in. engine lathe for machining mill shell heads and gears. On Friday trips were scheduled to the Kearney and Trecker Corporation, and the new Oak Creek Power Plant of the Wisconsin Electric Power Company. Kearney and Trecker Corporation, a pioneer in the metalworking industry, has recently added to its plant a $5 million Special Machinery Division. At the Oak Creek Power Plant visitors saw a 120-000-kw unit with many unconventional design features such as "Fair Weather" coal boat slip, controlled-circulation boiler, and compact cross-compound turbines.

A unique opportunity was afforded visitors to the Oak Creek Power Plant in that one of the stops during the trip was an inside view of the No. 2 boiler from the furnace bottom

Women's Program

Special events for the women guests at the Meeting included a luncheon and millinery show at the Chalet-on-the-Lake on Wednesday, and a Brunch at the White Manor Inn on Friday. The women joined the men for the other social events, including the Golden Anniversary Gayeties Party, the Gemütlichkeit Party, the President's luncheon, and the banquet.

Committees in charge

The committees in charge of arrangements for the Fall Meeting included the following: *Meetings:* J. K. Louden, *chairman;* J. H. Davis, R. W. Flynn, G. R. Fryling, W. M. Morley, C. W. Parsons, and D. R. Silvestrini; E. C. Koerper, *General chairman; Entertainment:* J. G. Surmacz, *chairman;* R. J. Sullivan; *Finance:* E. P. Hansen, *chairman;* G. V. Miniberger; *Hotel:* J. G. Van Vleet, *chairman;* T. Warming; *Inspection Trips:* F. J. Hartshorn, *chairman;* R. H. Meiners; *Information and Registration:* A. C. Holmes, *chairman;* J. Gammell; *Publicity:* G. F. Leitner,

Food, drink, and entertainment were on tap during the "Gemutlichkeit Party" tendered by Blatz Brewing Company for ASME members and guests

chairman; H. G. Holler; *Reception:* Robert Cramer, Jr., *chairman;* A. Schmidt; *Service,* E. J. Risseeuw, *chairman;* R. H. Losse; *Technical Events:* R. D. Teece, *chairman;* L. T. Brinson, Jr.; and *Transportation:* R. B. Adams, *chairman;* A. G. Hoppe.

Crosby Field Proves Mechanical Engineering Is a Profession

In his address on "The Crowning Achievement of Our Profession" Crosby Field, Fellow ASME, president, Flakice Corporation, made evident in nine points that mechanical engineering is a profession.

Speaking before a large audience at an ASME Minneapolis Section Meeting, Colonel Field stated that the profession with its code of ethics, its high aims and accomplishments, and its contributions toward the stamping out of "slavery" are a few among the many reasons why mechanical engineering is a profession.

Colonel Field's nine points are as follows:

1 Is mechanical engineering a profession or a trade? All professions have certain characteristics in common, including customs, codes, rules for practice and for dealing with the public and with each other; they show concern over the qualifications of their members and the training of applicants. So do the trades, and so did the guilds of both ancient and mediaeval times. In these common characteristics, therefore, we find no difference between them in kind, only in degree.

2 What do we find in the longer established professions that we do not find in the trades, and which, therefore, may distinguish them from the trades? We find the aim (or objective) of *a definite crowning contribution to or for the individuals comprising the general public which aim is worthy enough to warrant a man's dedicating his life to aid in its accomplishment.*

3 The clergyman strengthens the spiritual life of the individual; the lawyer secures life and property to the individual; the physician gives to the individual health and freedom from disease. Has the engineer such a crowning achievement that warrants including him as a professional man?

4 Colonel Field then showed that high standards of living or a rapid rise in them, and that rapid increases in technological skills and their diffusion, were not limited to the age of the engineer.

5 Before proceeding with our search for the crowning achievement of the engineer, let us take a brief glance at civilization itself. Civilization, as the derivation of the word itself indicates, is a product of the city. In order to build and operate the houses, streets, sewers, walls, protective weapons, and essential public buildings of a city, some form of power is essential. Before the engineer, the source of all such power was muscle, the muscle of slaves.

6 The engineer has, however, given us sources of mechanical power and their application to fulfill the needs of an organized culture. This substitution of mechanical power for muscle power has had tremendous results. For the first time in history the artifacts of a culture can increase without a corresponding increase in the number of slaves; in fact, it increases with a decrease in slavery! In the Western World of the engineer slavery has decreased to almost zero.

7 Because of the elimination of slavery as a necessary foundation of civilization all spiritual and human relationships have been greatly bettered: This is true not only of our relationship with foreigners, but also those with our fellow citizens, and even within the family unit itself. Our fears have been lessened and our entire mental atmosphere has sweetened. In the past the foreigner had to be considered only as a potential slave or a possible master. The brutality inherent in a slave system affected the nature of all, master or slave, and was evident in the families of the former.

8 Colonel Field then gave a brief history of slavery, from the code of Hammurabi, 5000 years ago, up to the present time. That it still existed was news to most—he quoted an August, 1954, news item in a Minneapolis newspaper. He startled his hearers by his statistics as to the enormous numbers of slaves "consumed" in any civilization of consequence. He further pointed out that "whereas at its most prosperous times, one third the population of Rome had three human slaves per capita, every American has 260 slaves on an energy basis." He also showed that slavery and its horrors were accepted by all men and women, because it was realized by them that muscle power was essential to their civilization and as such, slavery must needs be right—and God-ordained. The whip, the control of a slave society, was used on wife and child as well as on servant. He gave illustrations of slavery right up to the present time.

9 The engineer by himself did not abolish slavery but he did remove the need of civilization for slavery. The crowning achievement of the engineer, therefore, is that "The Engineer Removes the Need for Slavery." On the foundation thus prepared by him the legal system of our modern free society has been built and the ideals of the great humanitarians of all ages become realities. Thus can engineering take its rightful place among the other recognized professions, with an aim and practice worthy of the best.

ASME Elects Three Fellows . . .

The American Society of Mechanical Engineers has honored three of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow one must be an engineer with acknowledged engineering attainment, 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and a member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or members of the Society to the Council, to be approved by Council.

The men whose outstanding contributions to their profession and to the Society were so honored are:

John Winslow Nickerson

John W. Nickerson, consulting management engineer, West Hartford, Conn., is widely known for his contributions in the industrial-relations field. For over 25 years he was with Cheney Brothers, Manchester, Conn., serving in the beginning under the direction of Henry L. Gantt, a pioneer in scientific management. Mr. Nickerson installed task and bonus methods in this company. He was later in charge of industrial engineering, industrial relations, technical research, and mill management. From 1942 to 1945 he was director of management, consultant division of the War Production Board, Washington, D. C. He was responsible for making industrial-engineering and labor-relations advice available to all American industry as well as to the military establishments, the War Labor Board, and other agencies. Since 1949 he has done supervising work in connection with industrial engineering and industrial relations. Mr. Nickerson represented textile management on the Textile Work Assignment Board established by the President of the United States, following the general textile strike in September, 1934. He was chairman of the Advisory Group on European Productivity for the Mutual Security Agency and consultant to the director of the Productivity and Technical Assistance Division of MSA. He was the recipient of the first Industrial Incentive Award given by the Society for the Advancement of Management in 1950. Mr. Nickerson has written many papers on management. In 1931 he was a member of the ASME Management Division Executive Committee.

Rudolph Ferdinand Onsrud

Rudolph F. Onsrud, president, Onsrud Machine Works, Chicago, Ill., and president, Onsrud Cutter Manufacturing Company, Libertyville, Ill., is a distinguished inventor and industrialist. In his ability to see machine-tool needs of the engineering profession and to set up manufacturing plants to supply the items he has envisioned, he has made his greatest contribution. He joined the Onsrud Machine Works in 1920 and became president in 1940. In 1922-1923 he designed and manufactured the first nonmetallic ball spacer for high-speed precision ball bearings. Mr. Onsrud devised a method of balancing 30,000 rpm air-turbine driven spindles and established markets in photoengraving, internal-grinding spindles, and woodworking machinery. From 1936 to 1938 he completed stocking project for M 1 Rifle Springfield Arsenal, Springfield, Mass., for the U. S. Government, including plant layout, special machinery, and tooling, comprising 46 separate operations. From 1943

to 1945 he served on the Advisory Committee to the Manufacturing Engineering Committee (ASME), for OPRD Research Projects on Milling. Among his other inventions are a vacuum pulley for high-speed spindles, a round-corner machine for woodwork, lubricating systems for high-speed spindles, a multiple-head router for gunstocks and shuttles, improved noncentrifugal turbine governor for spindles of 50,000 rpm and over, and skin-milling machines for sheet tapering as required in jet aircraft. His recent efforts have been toward developments in the field of high-speed machine tools for jet-propelled airplanes wherein the components require internal sculpturing—that is, the removal by milling of the majority of the metal to produce internal ribbing of meandering contour and at the same time producing variable angles. The movements of these machines are controlled by templates and remote-tracer means. He has written many articles for trade journals and holds numerous patents.

Julius Roy Tanner

J. Roy Tanner, president of Tanner and Arnold, Inc., Pittsburgh, Pa., is known for his many contributions to the field of standardization. For 35 years Mr. Tanner was with the Pittsburgh Valve, Foundry and Construction Company. He joined the company as construction engineer in 1902 and was successively chief draftsman, chief engineer, general manager, and vice-president. He became president of the company in 1931. From 1937 to 1951 he was a partner and sales engineer for Tanner and Arnold. The partnership was incorporated in 1952. Since 1921 he has been active on numerous committees and subcommittes of the American Standards Association. These include: Sectional Committee B16 on Steel Pipe Flanges and Flanged Fittings; chairman, Subcommittee No. 5 on Face to Face Dimensions of Ferrous Flanged Valves; Sectional Committee B18, Standardization of Bolt, Nut, and Ring Proportions; Sectional Committee B31, Code for Pressure Piping; Sectional Committee B36, Wrought-Iron and Wrought-Steel Pipe and Tubing; chairman, Subcommitte No. 3 on Pipe and Tubing for High Temperatures; chairman, Subcommittee No. 1 on Revision of Wrought-Iron and Wrought-Steel Pipe, and several others. From 1928 to 1951 he was consulting engineer for Pipe Fabrication Institute. Since 1931 he has been active on committees of the American Society for Testing Materials. Mr. Tanner holds several patents covering hydraulic and steam valves. He has written numerous technical papers.

Columbia University Holds Symposiums Marking Technical Societies' Anniversaries

More than 100 experts on air conditioning and refrigeration gathered at Columbia University, September 13, for a two-day meeting sponsored by the School of Engineering, department of mechanical engineering.

Elmer R. Kaiser, director of research, American Society of Heating and Ventilating Engineers, told the group that future research must be turned more toward the human needs than to machinery.

"Our first basic-research program," Mr. Kaiser said, "is to discover the reactions of humans to environmental conditions. We should know the human being better."

Mr. Kaiser declared that engineers must determine the true needs of people, both for comfort and for best working conditions.

There has been a gradual change in the habits and dress which has caused engineers to reappraise standards of comfort. American people used to be satisfied with winter indoor temperatures of 68 degrees, but today they demand indoor temperatures of 75 degrees.

Mr. Kaiser attributes this partly to more comfortable automobiles, which are well enclosed and heated. Clothing is also lighter in winter than formerly.

Louis N. Hunter, vice-president in charge of research, National Radiator Company, presented an illuminated scroll to Columbia University on behalf of ASHVE, of which he is president. The scroll was presented to Columbia in recognition of the advances in the arts, sciences, and all the learned professions achieved during its 200-years' existence." Mr. Hunter said ASHVE has spent $2 million on research since it was founded in 1895.

The conference marked several anniversaries: Tenth, Refrigeration Research Foundation; Twentieth, ASME Process Industries Division; Fiftieth, American Society of Refrigeration Engineers; Sixtieth, ASHVE; Nintieth, Columbia School of Engineering, and Two-Hundredth of Columbia University.

Left to right **are: L. N. Hunter, ASHVE president; John A. Krout, vice-president and provost of Columbia University; Prof. C. F. Kayan, executive officer, department of mechanical engineering, Columbia; and Walter Fleisher, past-president, ASHVE**

ASME Calendar of Coming Events

Nov. 28–Dec. 3
ASME Annual Meeting, Statler Hotel, New York, N. Y.
(Final date for submitting papers was July 1, 1954)

Feb. 16, 1955
The Founding Anniversary Meeting, McGraw-Hill Building, New York, N. Y.
(No formal papers will be presented)

March 23–24, 1955
ASME Management Conference, Hotel Statler, Cleveland, Ohio
(Final date for submitting papers was Nov. 1, 1954)

April 6, 1955
ASME Machine Design Division Conference, as part of the Centennial Celebration, New York University's college of engineering

April 16, 1955
The Organization Anniversary Meeting, Stevens Institute of Technology, Hoboken, N. J.
(No formal papers will be presented)

April 18–21, 1955
Diamond Jubilee Spring Meeting, Lord Baltimore and Southern Hotels, Baltimore, Md.
(Final date for submitting papers—Dec. 1, 1954)

April 25–26, 1955
ASME Instruments and Regulators Conference, University of Michigan, Ann Arbor, Mich.
(Final date for submitting papers—Dec. 1, 1954)

June 5–10, 1955
ASME Oil and Gas Power Conference, Hotel Statler, Washington, D. C.
(Final date for submitting papers—Feb. 1, 1955)

June 15–17, 1955
ASME and The Institution of Mechanical Engineers, London, England, Joint Conference on Combustion, Massachusetts Institute of Technology, Cambridge, Mass.
(Final date for submitting invited papers was Nov. 1, 1954)

June 19–23, 1955
Diamond Jubilee Semi-Annual Meeting, Hotel Statler, Boston, Mass.
(Final date for submitting papers—Feb. 1, 1955)

Sept. 12–16, 1955
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Los Angeles, Calif.
(Final date for submitting papers—May 1, 1955)

Sept. 25–28, 1955
ASME Petroleum-Mechanical Engineering Conference, Jung Hotel, New Orleans, La.
(Final date for submitting papers—May 1, 1955)

Nov. 13–18, 1955
Diamond Jubilee Annual Meeting, Hotel Congress, Chicago, Ill.
(Final date for submitting papers—July 1, 1955)

ASME IRD Participates in First International Instruments Congress

THE Instrument and Regulators Division program of The American Society of Mechanical Engineers was presented at the First International Instrument Congress and Exposition in Philadelphia, Pa. The technical sessions were held Sept. 15–17.

G. P. Harnwell welcomed the scientists and engineers on "behalf of the foremost handmaiden of science and industry, which is instrumentation."

In his address "Physics, Mother of Instrumentation," President Harnwell of the University of Pennsylvania, traced the history of instrumentation from the earliest measuring devices known to have been in use in the valleys of the Nile, the Tigris, and the Euphrates, to instrumentation as it is known and applied today in science and industry.

"The development of instrumentation characteristic of the present century," he stated, "has been closely related to the enormous technical and ideological developments in physics itself. The work of physics has been concerned with the description of physical phenomena in terms of atomic and molecular and nuclear concepts, and the discovery of the electron had probably as much influence on the direction of instrumental development as the discoveries by Ampere, Henry, and Faraday of electromagnetic forces. Electronics is possibly more a descriptive cognomen for a field of instrumentation than it is for a field of technology. The large range of power amplification, the speed of response, and convenience of the auxiliary components have combined in electronics to bring about a revolution in the older methods of instrumentation and to open up additional fields of application heretofore unavailable. Electronic instrumentation has made possible the practical exploitation of the discoveries of nuclear physics. For the availability of nuclear explosives, as well as nuclear power, we are dependent upon the instrumental developments in electronics which characterized the preceding quarter of a century. While the utilization of free thermo or photoelectrons is commonly considered the basis of electronic technique, this might well be expanded to include conduction phenomena in solids, liquids, and gases. Indeed, gaseous electronics is already a well-recognized subdivision of electronic instrumentation and the thermistor and transistor and crystal rectifier are rapidly serving as central developments about which the next phase of electronic instrumentation is nucleating.

G. P. Harnwell, President of The University of Pennsylvania, makes keynote address at IRD Luncheon

"It is interesting to note," President Harnwell added, "that the progress of atomic physics during the first half of this century was characterized, first, by research in gas conduction and, second, by research in solid conduction, and that the development of atomic theory applicable to phenomena in these areas has been extensive and successful.

He went on to say, "The controlling instrument replaces a human being and in its proper role does an infinitely superior job in the performance of those functions which it is called upon to perform. Our technological development has already reached the stage where it would be impossible to conceive of telephone centrals, or petroleum refineries, or power stations operated by human beings without the existence of these devices, and we have probably made but a small start upon the opportunities which these present in raising the per capita efficiency of men."

Terminology

On the basis of papers presented, the British and German instrument groups have made appreciable strides in standardizing on terminology. It is the hope of the British that American groups will be able to agree in principle with their approach so that there will be an English-speaking unified terminology. In the United States, ASME and ISA have gone off in one direction, AIEE in another, and IRE in a third. There are also other U. S. instrument groups which have done their own work in the field of instrument terminology. A new committee headed by M. A. Princi of General Electric, West Lynn, Mass., has been formed to study both the British, German, and various American terminology patterns with the idea of coming up with a proposal for a formal ASA terminology program. Activities

Albert F. Sperry, *left*, Mem. ASME, president, Panellit, Inc., Skokie, Ill., and first president of the Instrument Society of America, receives a gavel from outgoing ISA president W. A. Wildhack, National Bureau of Standards, at the ISA members' banquet held at Convention Hall, Philadelphia, Pa., September 15. The banquet was a high light of the first International Instrument Congress and Exposition. Mr. Sperry, in turn, presented gavels to other ISA past-presidents and incoming ISA president, Warren Brand, Conoflow Corporation.

of this new committee will get under way in early 1955.

Education

Dean L. M. K. Boelter of UCLA, emphasized the need for giving serious thought to the shaping of education at the graduate level for professional engineering. He stated that such a training should be based on design in the full sense of the word—uncovering of new ideas, as well as the processing and analyzing required to carry these ideas into realization, and paying attention wherever necessary to the human element in systems. He said that no satisfactory professional training could be based on just an advanced treatment of the undergraduate engineering-science courses, and also underlined the need for a great growth in the number and quality of two-year schools for the training of technicians, who must, in the years to come, do much of the work now accomplished by engineers.

Prof. Robert J. Jeffries of Michigan State College stressed the need for a great development in the teaching and research activities of technical schools in the area of instrumentation. One of the stated problems was the need for European engineering schools to deal with a larger number of students than they now do. This was contrasted to the need of engineering schools in this country to find ways of handling the large groups that they now have, and providing the attention to the individual which is essential to the highest level of training for professional work.

Dr. H. J. Hadow, Scientific Attaché, United Kingdom Scientific Mission, Washington, D. C., presented Dr. Willis Jackson's paper on "The Education and Training of Professional Engineers in the United Kingdom," which told of the training of men in Great Britain for positions of engineering responsibility. Dr. Jackson is allied with Metropolitan Vickers Electric Co., Ltd., Trafford Park, Manchester, England.

"Servo Teaching in France, With Special Reference to Aeronautical Engineers," was the subject of a paper by Prof. J. Charles Gille, École Superieure de l'Aéronautique, Paris, France. He discussed the history and special problems of servo education in France as compared with the United States and outlined the teaching techniques employed in the automatic-control field with French aeronautical engineers.

The Friday morning session was devoted to a ten-year review of instrumentation; the afternoon session, to the subject of the economics of instrumentation.

Availability List For 1954 ASME Instruments and Regulators Division Conference

The papers in this list are available in separate copy form until July 1, 1955. Please order only by paper *number;* otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Paper No.	*Title and Author*
54—IRD-1	The Education and Training of Professional Engineers in the United Kingdom, by Willis Jackson
54—IRD-2	Ten Years of Progress in Instrumentation in the Steel Industry, by J. W. Percy
54—IRD-3	The Integration of Concepts in the Terminology of Measurement and Control, by H. L. Mason
54—IRD-4	A German-English Dictionary of Automatic-Control Terms, by D. W. Pessen
54—IRD-5	Servoteaching in France With Special Reference to Aeronautical Engineers, by J. C. Gillie
54—IRD-6	The Standardization of Automatic-Control Terminology in Germany, by R. Oetker
54—IRD-7	Terminology Applied to Automatic-Control Combinations, by L. A. Ledgett
54—IRD-8	The Role of Measurement and Instrumentation in Engineering Education, by J. A. Hrones
54—IRD-9	Instrumentation Problems in the University, by R. J. Jeffries
54—IRD-10	ASME and BSI Terminologies for Process Control, by A. J. Young
54—IRD-11	Professional-Engineering Education, by L. M. K. Boelter
54—IRD-12	Advances in Null-Type Recorder Design, by I. F. Kinnard, M. A. Princi, and A. Hansen, Jr.

Agenda Items for 1955 RAC Meetings

The 1955 Agenda Committee has asked the sections to set up an Agenda Committee to expedite the collection, editing, and submission of agenda items. This Committee has been asked to canvass the membership for items and it is hoped you will support this effort one-hundred per cent. The collection of these items and the invitation to the membership to submit them through their sections is a step in the democratic process by which the membership and the sections impart their ideas to the Council.

If you live within the boundary of a section and have not been approached, we suggest you submit your items to the secretary of your section. However, if you are outside the limits of a section, we suggest you address your items to the 1955 ASME Agenda Committee, 29 West 39th Street, New York 18, N. Y. Please study the wording of your proposed items to be sure they are clear and specific, and that there can be no misunderstanding as to intent. Also, be sure the wording is positive so that action can be taken either to "approve" or "reject" the item as worded.

The following is a suggested form we ask you to use in submitting items:

ASME AGENDA ITEM

PROPOSED BY ..... of the ..... Section

Address .....

Date .....

Item: It is proposed that

Proposer's Comments:

.....
Signature

It is earnestly requested you submit your items immediately to make it possible to mail the first compilation of the agenda by the first of the year. The second compilation must be ready for distribution by March 15 at the latest, so as to reach sections in adequate time prior to the Regional Administrative Committee meetings. The tentative schedule is shown in the accompanying box.

Tentative Schedule 1955 RAC Meetings

Region	Date	Day	City	Meeting Place
VI	March 25–26	Fri.–Sat.	St. Louis, Mo.	Gatesworth Hotel
III	March 30–31	Wed.–Thurs.	Allentown, Pa.	Traylor Hotel
IV	April 2–3	Sat.–Sun.	Charlottesville, Va.	Monticello Hotel
V	April 4–5	Mon.–Tues.	Youngstown, Ohio	Pick-Ohio Hotel
VIII	April 24	Sunday	Houston, Texas	Rice Hotel
VII	April 29–30	Fri.-Sat.	Berkeley, Calif.	Claremont Hotel
II	May 2–3	Mon.–Tues.	Elizabeth, N. J.	Elks Club
I	May 7	Saturday	Providence, R. I.	Brown University*

* Delegates will be housed at Sheraton-Biltmore Hotel, Providence, R. I.

ASME Membership as of September 30, 1954

Honorary Members	56
Fellows	394
Members	14,336
Affiliates	316
Associate Members (33 and over)	3,587
Associate Members (30–32)	3,164
Associate Members (to the age of 29)	17,667
Total	39,520

ASME Organizes Committee on Professional Practice of Consulting Engineering

Under the chairmanship of Harry R. Westcott, president, Westcott & Mapes, Inc., New Haven, Conn., Fellow ASME and former vice-president of the Society, reorganization of the Committee on Professional Practice of Consulting Engineering has been actively under way for several months. Secretary of the Committee is Frederick Franz of New Haven.

The Committee is organized under the Board on Education and Professional Status of The American Society of Mechanical Engineers.

Purpose of Committee

The purpose of the Committee has been stated as follows: "To promote the standards, development, and utility of, and interest in, the Professional Practice of Consulting Engineering to the end that it may serve commercial and industrial enterprises and public needs more effectively and efficiently."

Current Activities

The current activities of the Committee cover a wide range of projects designed to carry out the foregoing statement of purpose with promptness and vigor.

In order to bring the work of the Committee to the attention of the entire membership of the Society, a session has been arranged as a part of the technical program of the 1954 ASME Annual Meeting, to be held at the Hotel Statler, New York, N. Y., Nov. 28–Dec. 3, 1954. At this session, which will be held on Friday, December 3, 9:30 a.m., two papers have been scheduled for presentation and discussion:

"Criteria in Selecting Consulting Engineers," by W. R. Herod, president, International General Electric Company, Inc., New York, N. Y.

"Control of Engineering Costs," by K. W. Reece, vice-president, Ebasco Services, Inc., New York, N. Y.

This session, which will be held on Friday, Dec. 3, at 9:30 a.m., should attract a large number of engineers engaged in consulting practice and those interested in the procurement of the services of consulting engineers.

Lowell Tech officials at special convocation. U. S. Vice-President Richard M. Nixon was awarded an honorary DS degree at a special fall convocation at Lowell Technological Institute, September 28. The occasion also marked the dedication of Cumnock Hall, the new auditorium-administration building named in memory of Alexander Goodlet Cumnock, a founder of LTI and first president of the board of trustees. A few of the department heads and members of advisory committees are shown with the guest of the day, *left to right:* Albert E. Chouinard, professor in charge of the leather engineering department; E. Daniel Lord of J. S. Barnet and Sons, Inc., Lynn, Mass., leather committee; Dominic Meo, Salem Oil and Grease Company, Salem, Mass.; Francis W. White, American Woolen Company, New York, N. Y., textiles committee; Nathaniel M. Mitchell, Barnes Textile Associates, Inc., Boston, Mass., textiles committee; John Lewis of the paper engineering department; Vice-President Nixon; Fritz S. Klein, Byron Weston Company, Dalton, Mass., paper committee; LTI President Martin J. Lydon, who conferred the honorary degree; Meith Maeser, United Shoe Machinery Corporation, Beverly, Mass., leather committee; Kenneth E. Bell, A. C. Lawrence Leather Company, Peabody, Mass., leather committee; James A. Leroy, McLaurin-Jones Company, Brookfield, Mass., paper committee; James H. Kennedy, chairman of the division of textile manufacturing; William B. Wheelwright, Cambridge, Mass., paper committee; Gordon Osborne, Warwick Mills, Boston, Mass., textiles committee.

Other activities of the Committee of general interest to all engineers which can be announced at this time include:

1 Preparation of a statement of ASME policy regarding competitive bidding for engineering work.

2 Revision of the ASME Manual on Consulting Practice, issued in 1940.

3 Initiation, with the American Institute of Architects, of an active program to develop a general form of contractural relationship with the architect and his clients.

The Committee on Professional Practice of Consulting Engineering is arranging a cocktail party to be held Tuesday, November 30, 4:30 p.m., at The Engineers' Club, 32 West 40th Street, New York, N. Y.

Personnel of Committee

The Committee on Professional Practice of Consulting Engineering, as at present constituted, is composed of the following personnel: Harry R. Westcott, *chairman;* Frederick L. Franz, *secretary;* Harold V. Coes, Robert E. Derby, A. M. Gompf, Frank M. Gunby, E. C. Johnson, A. Wilson Knecht, Alf Koflat, J. N. Landis, John A. McPherson, D. F. Phelps, Joseph Pope, Ralph C. Roe, James M. Todd, Nathan T. Veatch, M. X. Wilberding, and Robert W. Worley.

ASME Establishes Nuclear Engineering Committee

The American Society of Mechanical Engineers has established a Nuclear Engineering Committee to co-ordinate the Society's activities in "those areas of mechanical engineering in which a knowledge of nuclear physics is essential."

Among these areas are core design, shielding, waste handling, fuels and fuel fabrication, radiation effect (with special emphasis on metals and safety), special equipment, and operation of nuclear power plants.

Chairman of the new committee is Albert C. Pasini, assistant general superintendent of production, The Detroit Edison Company.

Other committee members are Wallace E. Belcher, Jr., research and development staff, Brown Instrument Company, Philadelphia, Pa., division of Minneapolis-Honeywell Regulator Company; Hendley N. Blackmon, engineer manager, association activities, Westinghouse Electric Corporation, East Pittsburgh, Pa.; Richard B. Engdahl, supervisor, Battelle Memorial Institute, Columbus, Ohio; Walter L. Fleischmann, welding engineer, Knolls Atomic Power Laboratory, General Electric Company, Schenectady, N. Y.; Herbert B. Nottage, research assistant, American Society of Heating and Ventilating Engineers,

Los Angeles, Calif.; and Richard H. Tingey, assistant technical manager, central technical department, Bethlehem Steel Company, Quincy Yard, Quincy, Mass.

Theodore R. Olive, senior associate editor of *Chemical Engineering*, is an ex-officio member, by virtue of his position as chairman of ASME's Board of Technology, of which the newly formed group is a task committee.

Advisory members are R. W. Hartwell, director of Nuclear Energy Development, The Detroit Edison Company, and Harvey A. Wagner, assistant manager of engineering, The Detroit Edison Company.

T. A. Marshall, Jr., of ASME staff, is secretary to the committee.

According to Mr. Pasini, the new committee will serve to co-ordinate a number of activities connected with nuclear engineering which are now carried out by various divisions of the Society, primarily those devoted to fuels, heat transfer, instruments and regulators, metals engineering, power, and safety.

He pointed out that increasing declassification of documents, made possible under the new Atomic Energy Act, will make the work of the committee more practical than it would have been in the past.

Primary assignments of the committee will be to plan for participation of ASME in a Nuclear Engineering Conference to be held under the auspices of Engineers Joint Council in the summer of 1955, and to study the Society's long-range needs in the field of nuclear engineering and recommend a method of organization within the Society.

It was emphasized that the Nuclear Engineering Committee is separate and distinct from ASME's Nuclear Energy Application Committee. The latter is a policy group. The former, under the normal procedures of ASME, could lead to the formation of an organization of professional-division status, similar to the 21 professional divisions through which much of the work of the Society is now processed.

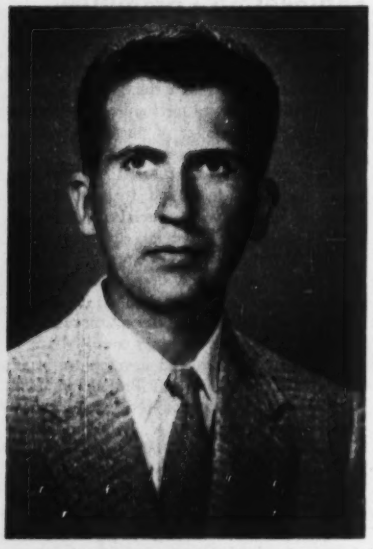
William H. Pugh was the only entrant to win prizes in both sections, symbol and slogan, of the contest

ASME 75th Anniversary Contest Winners Announced

The American Society of Mechanical Engineers has announced the names of winners in its contest to find a suitable symbol and motto for its 75th anniversary celebration in 1955.

Andrew T. Lemmens, design engineer with The Gleason Works, Rochester, N. Y., will receive $250 for his prize-winning design. David H. Ray, retired mechanical engineer of North Tarrytown, N. Y., received the top award of $250 for his motto, "By Truth and by Service."

Mr. Lemmens' design combines a representation of the intersecting orbits of the atom—traditional symbol for nuclear power—with a representation of the thermodynamic cycle, by which heat is converted into energy and back again.



Andrew T. Lemmens, design engineer, The Gleason Works, Rochester, N. Y., who will receive $250 for his prize-winning symbol

The Prize-Winning Symbol is a Nuclear-Energy Cycle of the present superimposed on a Carnot Thermodynamic Cycle of the past, and their effect on the world in which we live

A 1949 graduate of Massachusetts Institute of Technology, Mr. Lemmens recently moved from Haddonfield, N. J., to Canandaigua, N. Y. He was formerly employed by Radio Corporation of America at Camden, N. J.

Dr. Ray, a former member of the faculties of City College of New York, Manhattan College, and California Institute of Technology, has served as mechanical-engineer examiner for the cities of New York and Los Angeles. He is the author of a brief history of mechanics. He holds degrees from City College of New York, Columbia University, and New York University.

The symbol will be embodied in the obverse of an anniversary medallion; on the reverse, the slogan with the traditional globe, lever, and hand will depict Archimedes' statement, "Give me where to stand and I will move the earth."

Regional certificate winners in the contest are as follows:

For the symbol: Kerr Atkinson, Wellesley Hills, Mass.; Crosby Field, Brooklyn, N. Y.; Captain R. H. Emerick, USNR, North Charleston, S. C.; William H. Pugh, Lakewood, Ohio; A. R. Montella, Oak Park, Ill.; Chris A. Christoff, San Gabriel, Calif.; Norman W. Read, Wichita Falls, Texas; D. Dresden, Delft, Netherlands.

For the motto: Sidney Saltzman, West Hartford, Conn.; Dominick F. Cafiero, Bayside, N. Y.; R. G. Coe, Syracuse, N. Y.; Robert E. Woodward, Columbia, S. C.; William H. Pugh, Lakewood, Ohio; W. A. Dutton, Des Moines, Iowa; Albert Crane, Los Angeles, Calif.; Robert F. Knox, Waxahatchie, Texas; Paul B. Eaton, Tainan, Formosa.

Mr. Pugh was the only entrant to win prizes in both sections of the contest.

ASME Machine Design Division Conference at NYU

On April 6, 1955, the Machine Design Division of The American Society of Mechanical Engineers, at the invitation of the Metropolitan Section, will hold a one-day Division Conference at New York University as a part of the celebration of the Centennial of their College of Engineering.

The theme of the Conference will be "Production Considerations in Machine Design." As the industrial market is becoming more competitive, the designer must pay increased attention to the reduction of production costs without a sacrifice in the quality of the product. It is felt that several papers on the approach to this problem would be of keen interest to designers. It is planned to cover such aspects as material selection, surface finish, and fabrication methods.

Stopping to investigate how the conference on the Administration of Research was operating, are, *left to right:* H. K. Work, director of the Engineering Research Division, New York University; E. P. Stevenson, president, Arthur D. Little, Inc.; P. R. Beall, consultant to Deputy Chief of Staff, Development, USAF, Pentagon; and E. A. Walker, dean of engineering, The Pennsylvania State University

Research Administrators Air Problems at Conference Held at NYU

RESEARCH workers are entitled to rewards for achievement, but what form such rewards should take is difficult to determine. This question is of increasing concern to research-administration executives since research has become a $4-billion undertaking in the United States. Other problems are the integration of research with other operations, the providing of facilities for research, and the recruiting of personnel.

The executives spoke at the opening of the eighth annual Conference on the Administration of Research. Two-hundred and seventy-five research leaders from industry, government, and universities attended the sessions held from September 8 to 10 in the New York University's Vanderbilt Hall. The conference also marked the beginning of the centennial celebration of NYU's college of engineering, which has the sixth largest university-engineering research division in the country, with an annual dollar volume of more than $2 million.

Edwin A. Speakman, general manager of the guided-missiles division of the Fairchild Engine and Airplane Corporation, noted that research developments are often not fully evaluated for several years, but that recognition of those responsible should not be delayed that long.

Scientific integrity and selflessness, the ability to channel a research project toward worth-while achievement, and the ability to get along with others are considered most important for promotion at Battelle Memorial Institute, its director, Clyde E. Williams, asserted. The three criteria of productivity, organization and personal responsibility, and professional activity and growth are used at National Bureau of Standards, its chief, Allan V. Astin, said.

The speakers agreed that monetary remuneration alone was not enough to encourage the researchers. John J. Green of the Canadian Defense Research Board, cited the British practice of recognition with medals and honors.

Welcome Luncheon

Delegates were officially welcomed at a luncheon following this session by Henry T. Heald, chancellor of New York University; Harold K. Torgerson, assistant dean of the college of engineering; and Harold K. Work, director of the NYU Engineering Research Division. Dean Torgerson described the educational role of research conducted in the University. "At New York University," he said, "research has given us an invaluable opportunity to advance our students, particularly on the graudate level, and to insure that academic instruction is in line with—if not in the forefront of—the most advanced knowledge and techniques."

Subsequent symposiums took up management in the research laboratory, communication problems in a research operation, physical facilities for research, and basic research in an applied research laboratory.

Communications in a Research Operation

The Thursday morning, September 9, session was devoted to means of maintaining communications within and among research laboratories—ranging from an informal mimeographed broadside to an extensive government clearinghouse credited with eliminating millions of dollars of waste and duplication. The "clearinghouse" is the Defense Department's Armed Services Technical Information Agency (ASTIA). Its director, Leslie E. Neville, told the conference that a possible third world war "is now being fought in the laboratories where victory or defeat will be decided."

Designing, building, and maintaining the physical facilities for research was the theme of the fourth symposium. Clifford F. Rassweiler, vice-chairman of the board and vice-president for research and development, Johns-Manville Corporation, compared the research laboratory to the production unit of a factory.

The only difference between them, he added, "is that instead of goods to be shipped in freight cars and trucks, the laboratory must produce information, scientific data, inventions, new products, solutions to manufacturing problems, technical aid for sales, and other intangible things that are essential to industrial profits."

In designing research laboratories, he advised, "attention should be paid to intangible factors that increase productivity of the individual research worker." He stressed the importance, from the employee's standpoint, to locate a laboratory near good schools and low-cost golf or swimming clubs. "A very high percentage of the most valued men we lose are lost because their wives don't like the community or don't think the community provides a suitable place to raise and educate a family."

He pointed out further that the research laboratory should be cheerful, comfortable, and spacious. This question was further developed by opinions from architects, researchers, and governmental and industrial representatives.

Basic Research in an Applied-Research Laboratory

According to Maurice Nelles, director, Borg-Warner Central Research Laboratory, a fundamental change has occurred in the research pattern; and Randolph Major, vice-president, Merck and Company, Inc., traced the development of cortisone as a product of joint academic and industrial basic research.

Thomas H. Vaughn, vice-president for research and development, Colgate-Palmolive Company, Jersey City, N. J., was named chairman of the Advisory Committee for the ninth annual Conference on the Administration of Research. The Executive Committee voted to hold the ninth annual Conference next

fall at Northwestern University, Evanston, Ill.

Los Alamos Scientific Laboratory Receives Signal Honor

A PRESIDENTIAL Citation was awarded on July 15, to the University of California's Los Alamos (N. Mex.) Scientific Laboratory for its outstanding achievements in the research and development of the nation's nuclear and thermonuclear weapons. The citation was presented for President Dwight D. Eisenhower by Lewis L. Strauss, chairman of the Atomic Energy Commission, to Norris E. Bradbury, director of the Laboratory, and members of its Technical Board, during a luncheon meeting at the Lodge. Attending the luncheon with Mr. Strauss, who had arrived in Los Alamos just a few hours before, was Brig. General Kenneth E. Fields, director of the Commission's Division of Military Application.

The Citation reads:

"The Los Alamos Scientific Laboratory, as the Nation's principal institution for the development of atomic weapons, has continued to discharge its responsibilities to the people of the United States with highest distinction and by its achievements has rendered invaluable service to the Nation and the free world.

"The Laboratory's momentous success in the field of fission weapons has been followed by equal accomplishments in the fusion field. These achievements are the result of a remarkable group endeavor and the devoted and skillful effort of the individuals of the staff of the Laboratory.

"In recognition of the outstanding achievements of the Los Alamos Scientific Laboratory and their contribution to the welfare and collective security of this Nation and the free world, this citation is awarded to the Laboratory as a means of expressing to all its members the gratitude of the people of the United States of America."

(SIGNED) Dwight D. Eisenhower

Third U. S. National Congress of Applied Mechanics

Preliminary Announcement

THE third U. S. National Congress of Applied Mechanics will be held at Brown University, Providence, R. I., during June 11–14, 1958. It is hoped that the scheduling of conflicting meetings can be avoided by this early announcement of the date chosen for the Congress. Further announcements concerning the preparation of papers will be made as the Congress draws nearer.

Inquiries regarding the Congress should be addressed to one of the following members of the Organizing Committee at Brown University, Providence 12, R. I.: Prof. D. C. Drucker, Secretary; Prof. E. H. Lee, Treasurer; Prof. W. Prager, Chairman.

ASEE Meeting Calls on Educators to Stress Fundamentals

ENGINEERS should become more scientific, more creative, and more human. This evaluation of current engineering education was the theme of the sixty-second Annual Meeting of the American Society for Engineering Education held June 14–18 on the Urbana-Champaign campus of the University of Illinois.

More than 1600 engineers, mostly teachers from colleges in every state of the union and many foreign countries, registered for the meeting. Dean Thorndike Saville of New York University's college of engineering received the Lammé Medal during the meeting.

Industrial employers, generally agreeing with the educators, said that they were unwilling to have colleges sacrifice the sciences and humanities to provide time for studying technology or administration. They insisted that their sales, manufacturing, and operating departments (as well as their research and development divisions) need engineers with strong scientific backgrounds.

Evaluation of Engineering Education

The extent of this move to strengthen science is shown by the proposal in an interim report of the ASEE's Committee on Evaluation of Engineering Education. This proposal would have all engineering students—whether majoring in chemical, mechanical, electrical, civil, or other branches of the field—study in common almost five sevenths of the total course. Only two sevenths would be concentrated in the field of major, and almost half of this as electives.

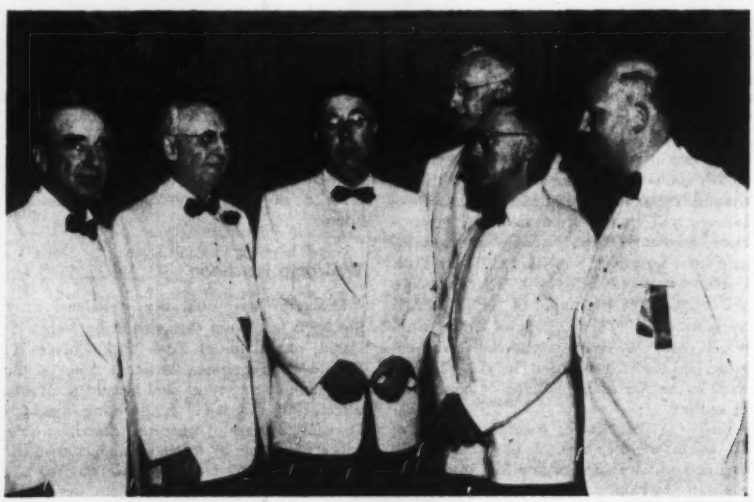
In his principal address of the meeting, Dean L. E. Grinter of the University of Florida, retiring president of the ASEE, said that colleges "must experiment with all possible methods of orienting engineering education more significantly toward basic and engineering science." He added that the greatest weakness of engineering education has been insufficient attention to integrating practice and specialized science so that students can understand the rules of engineering through their scientific knowledge. Dean Grinter said that the engineer must be inherently creative, putting together a combination of theories, concepts, techniques, and experience in new patterns.

Emphasis on Science

The emphasis on science was continued by Lee A. DuBridge, president of the California Institute of Technology, who spoke at a celebration of the fiftieth anniversaries of the engineering experiment stations at the University of Illinois and at Iowa State College. "Maintain a close tie with the basic sciences," was Dr. DuBridge's advice. "An engineer, after all, is putting to practical use today what scientists discovered yesterday." Still more important, Dr. DuBridge stressed, is the fact that the work he must do tomorrow will grow out of what the scientist is working on today.

"The main purpose of science," said Dr. DuBridge, "is not to produce bombs and guns and radar—or even radios, refrigerators, and color TV, but to advance human understanding."

Despite the high purposes of science, too few high-school students are being led to a study of science, according to Lenox R. Lohr, president of Chicago's Museum of Science and Industry. Major Lohr told the attendents at the annual



Recipients of the two highest ASEE awards pose at the banquet, June 17, of the sixty-second annual meeting. *Left to right* are: Lenox Lohr, president, Museum of Science and Industry, Chicago, Ill., and the banquet speaker; Lloyd Morey, University of Illinois; T. J. Higgins, Westinghouse Award winner; L. E. Grinter, retiring president of ASEE; Thorndike Saville, recipient of Lammé Medal and dean of NYU's college of engineering; W. L. Everitt, University of Illinois.

Notables attending the sixty-second annual meeting of the American Society for Engineering Education at the University of Illinois are shown inspecting the University's computer. *Left to right* are: Prof. John P. Nash; Lloyd Morey, president, University of Illinois; Major Lenox Lohr, Chicago Museum of Science and Industry; Dean L. E. Grinter, retiring president of ASEE; Dean Emeritus M. L. Enger of the University of Illinois college of engineering, host institution.

banquet of the society that only four per cent of Chicago high-school students are studying physics and no more than one-half per cent are studying solid geometry.

"Uninspired and inept instruction have too frequently made these all-important subjects a nightmare for the student," Major Lohr said. "The teacher should emulate the good salesman—be convinced of his subject's importance, know that his student has a vital need which he can supply, and induce the student really to want it by employing those devices which make it most palatable and persuasive."

Engineering Manpower

A report based on a survey conducted by the Engineering Manpower Commission of the Engineers Joint Council provided information on the current demand for engineering graduates. It was concluded that the decline in business activity and defense orders in 1954 has led to a decrease in the requirement for engineering graduates of about 20 per cent. Yet despite this decrease, there is still a substantial unfilled demand.

Eight Elements of Education for Engineers

George M. Keenan, director and vice-president of the Pennsylvania Power & Light Co., stated that the work done by engineers in an operating electric utility covers such a broad range that opportunities for an engineering graduate are practically unlimited. He set forth eight elements of education for all engineers to have.

1 A sound *foundation* in and *knowledge* of the political organization of the United States at the federal, state, and local levels, and of the American economic system.

2 A knowledge and realization of the necessity of working with and thinking of other people.

3 A basic knowledge of the fundamentals of business organization, labor relations, and personnel administration.

4 An ability to organize his work and an appreciation of the value of time. Schedules must be met, decisions must be made, work must get done, not just started.

5 An appreciation of values in terms of the dollar no matter how inflated or deflated. We call this cost-consciousness.

6 A sound foundation in engineering mathematics, engineering physics, engineering chemistry, dynamics, and the properties of engineering materials.

7 A broad knowledge and understanding of the language of engineers.

8 The ability to analyze problems, think clearly, and express the thoughts logically, both orally and in writing.

Smithsonian Institution to Reconstruct Hall of Power Machinery

THE Smithsonian Institution, Washington, D. C., is scheduling a reconstruction of its Hall of Power Machinery during the current fiscal year. Robert P. Multhauf, associate curator of the Division of Engineering, is handling the exhibits, which are being redesigned to illustrate the history of the development of power machinery.

In this connection they are seeking assistance from engineers who may be able to help them obtain both original machines and scale models of certain specific items. Limitations of space will make it necessary to substitute scale models for full-sized machines in many cases. Some they may have to construct.

Among the original machines, they are most desirous of obtaining the following: (1) Lenoir gas engine or Otto and Langen gas engine; (2) Francis hydraulic turbine (preferably cutaway); (3) Pelton hydraulic turbine (early model); (4) De Laval steam turbine (early model); and diesel engine (early model). The scale models they seek include the following: (1) Hydraulic turbines: Fourneyron, Jonval, Howd, Girard; (2) Reciprocating steam engines: Willans, Uniflow; (3) Gas engines: Clerk or other early two-cycle engine; (4) Gas turbines: Armengaud and Lemale, Holzwarth.

To facilitate matters any information available on the afore-mentioned machines should be sent to Mr. T. A. Marshall, Jr., ASME, 29 West 39th Street, New York 18, N. Y.

Literature . . .

Germany-English Dictionary

READING and translation of German literature on automatic controls are made easier by a new German-English dictionary of automatic-control terms just published by The American Society of Mechanical Engineers.

The dictionary with about 750 German words and their English translations or equivalents was compiled by D. W. Pessen, research engineer, Servomechanism Laboratory, Brown Instruments Division, Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., and presented as a paper at the recent ASME Instruments and Regulators Division Conference in Philadelphia, Pa.

Most of the terms in the dictionary stem from articles in the German publication *Regelungstechnik* (Automatic Control Technology) and from the recently published German Automatic Control Terminology Standard. An appendix to the dictionary lists German automatic-control symbols.

Copies of the paper, No. 54—IRD-4, are available at 50 cents each from Order Department, ASME, 29 W. 39th St., New York 18, N. Y.

New Marketing Publication

THE Office of Distribution, Business and Defense Services Administration, announced the conversion of their monthly publication, the *Distribution Data Guide*, to a subscription basis commencing with the October, 1954, issue.

The *Guide* lists brief annotations of selected recent publications and reports, both government and nongovernment, which contain basic information and statistics for use in market research, merchandising, sales promotion, advertising, and allied subjects of interest to businessmen and others engaged in the distribution of goods or services.

A year's subscription to the *Guide* includes 12 monthly issues and two cumulative subject indexes which list material annotated in the preceding six months. The annual subscription rate is $2 to a domestic address and $2.50 to a foreign address. Individual copies of the *Guide* sell for 15 cents, and the indexes for 20 cents.

Subscriptions will be received by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., payable by check or money order in favor of the Superintendent of Documents. Subscriptions may also be made through local Department of Commerce Field Service Offices.

Large-Scale Application of Atomic Power Predicted at IEC Golden Jubilee Conference

Atomic-Power Applications, Electrical Usage and Technology, Standardization, and Economic Co-Operation Bases of International Meeting

LARGE-SCALE applications of atomic power may be only four or five years away and not only will eventually provide new life to declining economic areas throughout the world but will open up vast arctic resources, Don G. Mitchell, chairman of Sylvania Electric Products, Inc., stated at an international meeting of electrical specialists.

The final impact of nonmilitary applications of atomic energy in changing the course of world affairs will be even greater than the atomic bomb, Mr. Mitchell said. He spoke to some 800 scientists and electrical engineers from 21 countries attending the Golden Jubilee Banquet of the International Electrotechnical Commission (IEC).

IEC is an international organization made up of the national standards bodies of 30 countries. IEC committees held two weeks of meetings, September 1–16, at the University of Pennsylvania, Philadelphia, Pa., in an effort to develop world-wide standards in electric power, light, and communications.

ASME Participation

The International Electrotechnical Commission was a natural consequence of a recognized need for widely accepted standardization for the electrical industry. In ASME, standardization of methods of testing power equipment started about 70 years ago. Because of the Society's experience and achievements in this field, it was suggested in 1925 that ASME through the Power Test Codes Committee participate in the work of IEC. The secretariates for the three international committees on prime movers are held by the United States. Meetings of the technical committees on hydraulic turbines, steam turbines, and internal-combustion engines were held in Philadelphia, Pa., September 1 to 16, and reports of their deliberations will be included in the December issue of MECHANICAL ENGINEERING.

Electrical Usage and Technology

During the day-long Jubilee Celebration, the Right Honorable Viscount Waverley, chairman of the Port of London Authority, declared, "A tremendous new era of electrical usage and technology lies ahead which will bring with it the ability to provide electrical power to vast areas of the world hitherto cut off from development by lack of fuel or water."

He predicted that consumption of electricity within the next 50 years would be at least 20 times what it is today.

"Clearly the demand in world markets for sound, well-designed electrical installations will be accelerated if, through greater standardization, the material and apparatus can have more general applications and can be produced and then maintained at a lower cost."

Standardization

He defined standardization as "a doctrine based on the principle of the greatest good for the greatest number."

"In building up new industries and services—and in re-equipping the old—the part played by international standards is vital. If the basic elements of electrical equipment are made to standard dimensions or to a standard level of performance, how much easier is it for the importer to choose the best equipment from all sources, knowing that parts can be replaced or interchanged with the minimum of difficulty. The techniques of installation and maintenance can be immensely simplified and more easily understood and hence the amount of skilled supervision—a costly item—can be reduced."

The speaker, as Sir John Anderson, was a Member of Parliament representing the Scottish Universities; Home Secretary and Minister of Home Security; and Chancellor of the Exchequer (1943–1945). The famous British "Anderson Bomb Shelters" were named for him. He is a past-president of the British Standards Institution.

A. C. Monteith, Hon. Mem. ASME, vice-president, Westinghouse Electric Corporation, spoke briefly at the Jubilee Banquet in his capacity as president of the American Institute of Electrical Engineers. Walker L. Cisler, Fellow ASME, president, Detroit Edison, Co., presided.

Jubilee-Day Papers

Among those who delivered technical papers during the Jubilee-Day celebration were Dr. Hakan Sterky, director general, Swedish Telecommunications; Pierre J. Ailleret, director of research, Électricité de France; and Lee A. DuBridge, president, California Institute of Technology. Harold S. Osborne, IEC president, presided.

In his address "Standardization—The Foundation of International Progress," Mr. Mitchell stated that the potentialities of atomic power have pushed the frontiers of world progress "back out of sight." He added: "Just how rapidly atomic energy is put to work to serve man rather than to destroy him will depend upon the degree with which technical information flows through the world.

"Atomic energy today is the field in which the opportunities for standardization, with its many contributions, far exceed those of any other field of engineering."

Economic Co-Operation

Speaking on "International Economic Co-Operation," Lord Waverley declared, "American productive power is so massive and so vastly exceeds her domestic needs that she must be increasingly dependent upon exports. Her productive appetite for raw materials is so great that it demands ever-growing imports.

"Hence it is inevitable that on all scores American policy must profoundly influence the fate of the rest of the world. This imposes on the American nation a responsibility of a magnitude which few of those who so readily offer advice would care—or indeed could attempt—to shoulder."

He added: "It is one of the disadvantages of having great power that you are constantly told what you ought to do with it, and I should not blame the Americans for regarding some of this proferred advice as both impetuous and ill-considered."

The IEC, which was founded in St. Louis, Mo., in 1904, has met only once before in the United States, in New York, N. Y., in 1926. It has produced 33 world standards in such fields as electrical rotating machinery, standard currents and voltages, and safety.

Resistance for Aluminum

Delegates from seven countries agreed on a basic international standard of resistance for aluminum, corresponding to the resistivity of very high-purity aluminum. The basic value of resistance agreed upon is 1/37 (equals 0.027027) ohm mm sq per meter.

In addition to the basic international standard, a value for the resistivity of hard-drawn aluminum wire was tentatively approved. This is to be 0.028264 ohm mm sq per meter as the maximum resistivity. This will be on trial for a period of six months before being given consideration for final approval.

Other resistivity values were approved on the basis of the new standard. The maximum resistivity value for aluminum bus conductors was set at 0.0290 ohm mm sq per meter. The committee also agreed on the basic standard mechanical values for galvanized steel wire for use in the cores of aluminum conductors, steel-reinforced.

On the basis of the agreements reached, the Canadian Secretariat for the committee will prepare specifications which will be circulated to the national committees of the 30 countries that are members of the IEC.

Letter Symbols

Delegations from eleven countries reached preliminary agreements on letter symbols used in connection with electricity.

Preliminary agreements were reached on letter symbols in the new fields of electronics and telecommunications as well as on detailed problems concerned with notation for vectors and phasors, and for instantaneous, root-mean-square, and peak values.

Earlier editions of the international electrical symbols, published in 1911, and again in 1920, have brought about world-wide use of such symbols as, for instance, "I" for current (originally this referred to "intensity of current") and "R" for resistance.

Junior Forum

Conducted by Joseph Schmerler, Assoc. Mem. ASME

Guests of the Old Guard attending the Junior Session of the 1954 ASME Fall Meeting are, seated, *left to right:* T. O. Menary, G. F. Leitner, E. G. Spewachek, speaker; J. J. Noble, Robert Nelson, B. L. Sturdevant; standing, *left to right:* J. W. Lannert, T. H. Gluck, J. A. Hill, L. E. Staak, J. A. Foster, Jr., and R. L. Airgood

Milwaukee Masters Manufacturing Through Engineering

THE Junior Session at the 1954 Fall Meeting, September 8, at Milwaukee, Wis., had as its theme "Milwaukee Masters Manufacturing Through Engineering," with Erwin G. Spewachek, assistant professor, mechanical engineering, college of engineering, Marquette University, Milwaukee, Wis., as speaker.

Old Guard Guests

Present as guests of the Old Guard were Associate Members G. F. Leitner, Milwaukee; Thomas O. Menary, Rock River Valley; J. A. Hill, Minnesota; B. L. Sturdevant, Iowa-Illinois; T. H. Gluck, Chicago; J. A. Foster, Jr., St. Joseph Valley; J. W. Lannert, Central Iowa; L. E. Staak, Fort Wayne; and R. L. Airgood, Central Indiana.

Made in Milwaukee

Mr. Spewachek related that in some of its industrial achievements, Milwaukee is distinguished from all other great cities of the world. The label "Made in Milwaukee" carries with it the confidence that both quality and price are what they should be. The Milwaukee manufacturer has taken pride in his calling. Every article bears the stamp of character, reliability, and mechanical excellence. Inventive genius has been employed with success so that the city has become a leader in many important products.

Milwaukee is rated as the tenth largest industrial city in the nation. The Directory of the Wisconsin Association of Manufacturers lists 1600 manufacturing concerns in Milwaukee and its suburbs. It is not dependent upon any single industry for its standing.

Because of the diversity of manufactured products, its industrial balance is maintained through abnormal times and seasonal fluctuations. Milwaukee provides machinery which builds world highways and canals, pipe that carries fuel oil and natural gas, and turbines which produce electricity. Milwaukee leads the world in the production of diesel and gasoline engines, outboard motors and motorcycles, tractors, wheelbarrows, and padlocks. It is the biggest veal-packing center, the greatest barley market, the location of four of the seven largest breweries in America. It leads the nation in the production of men's, women's, and children's hosiery, work shoes, leather gloves and mittens, tin and enamelware, sawmill and flour-mill equipment.

Milwaukee's Industry

Milwaukee's industry began with the simple mechanic in overalls. The real impetus to Milwaukee's industrial character came from immigrants who had acquired their vocational training in the Old World. They were, in the main, skillful artisans who could produce a great variety of useful things. For a time they served local needs only, but soon expanded their activities and found a market for their products beyond the borders of the city. The momentum which attended these efforts can in large part be explained by the fact that these mechanics were not only skillful but also believed in honorable methods in the marketing of their wares. These early manufacturers kept high standards of excellence and, even under competition, aimed at honesty and reliability of products.

The essentials for the building of an industrial center were at hand—the little backyard shop with its boss, journeyman, and apprentices. Nearly all the great industries of the city can trace their origin to some simple mechanic who learned his trade in the Old World and came here to carry into practice what he had learned. In time his small backyard shop grew into a factory employing at first a few journeymen, then more, until a real plant was in operation. Then came the genius of invention and the machine augmented hand labor. A succeeding generation introduced mass production and well-planned methods of distribution. Industrial ownerships were expanded into huge corporations.

Engineering Is a Profession

Since engineering is a profession which adapts materials found in nature into a form more useful to mankind by the use of natural forces, machines, and people, at a cost in effort which the user can afford to pay, the modest mechanic in overalls as the forerunner and founder of industrial enterprises was an engineer. Many of the pioneering engineers never attended an engineering college, yet were engineers in the true sense when the general technology was relatively simple.

Before 1900 most of the manufacturers had relatively small plants. Because of expanding markets, many businessmen saw the advantage of the corporate type of business organization. Several companies were combined into one, thus making greater amounts of capital available for expansion of equipment and facilities. These combinations made possible large-scale production which required the use of complex and expensive machinery, increasing the specialization of the worker, and the standardization of methods and products, all of which created a demand for engineers.

Technical Training

The industrialists of that time felt that there was a need for technically trained men in industry. Oscar Werwath formed the Mil-

waukee School of Engineering in 1903, for the purpose of training technicians and electrical engineers. The college of engineering at Marquette University was opened in 1908 to train civil, electrical, and mechanical engineers.

Engineers Society of Milwaukee Organized

The German Polytechnic Society which first met in 1889, and performed the pioneer work of organizing the professional engineers, was the forerunner of the Engineers Society of Milwaukee, founded in 1904. The Society was incorporated and the ESM officially came into existence with a membership of fifty nine. In 1904 the Milwaukee Section of the ASME also came into existence.

A number of other events took place which also had an effect upon engineering in Milwaukee. The ESM began to publish a monthly pamphlet called "Milwaukee Engineering" in 1921. In 1923 the first two years of an undergraduate engineering curriculum were given at the University of Wisconsin in Milwaukee. Graduate work in metallurgy was also begun but later dropped. As a result of the increased demand for specialization in engineering, the graduate program for a master's degree was re-established at the University of Wisconsin in Milwaukee in the year 1948. In 1923 the Vocational School in Milwaukee began to give technical engineering courses at night. This program is now considered to be run under the Milwaukee Institute of Technology, its new name. In the fall of 1950 an undergraduate evening program in engineering was set up by Marquette University to further serve the community.

In September of 1946, open house was held in the new ESM Building, marking another important event in the history of engineering in Milwaukee. At the present time ESM membership is approximately 1500. There are 14 affiliated societies with a total membership of about 4300.

Engineers Were Journeymen Mechanics

Fifty years ago many engineers were journeymen mechanics before they undertook their formal education. Today such a case is exceptional and of course such men are in great demand. Years ago many products were tried out and designed on a trial-and-error basis.

If the designer made several members too heavy, it did not increase the cost too greatly, and competition was not so strong that a slight increase in cost would result in the loss of any order. Today the engineer must conserve on material and labor, whenever possible, to hold the cost down to remain in competition in the field.

Milwaukee mastered its manufacturing by evolving from the simple journeymen-mechanics' production method to the engineer who developed new products, new equipment, and new ideas to furnish more goods to the consumer at a price he can afford and through the use of mass-production techniques.

Actions of the ASME Executive Committee

At a Meeting at Headquarters, Sept. 15, 1954

A MEETING of the Executive Committee of the Council was held in the rooms of the Society, Sept. 15, 1954. W. F. Thompson of the Executive Committee presided in the absence of L. K. Sillcox. who was ill. In addition to Mr. Thompson there were present: Thompson Chandler, H. E. Martin, and A. C. Pasini of the Executive Committe; Joseph Pope, chairman, Finance Committee; V. Weaver Smith, chairman, Organization Committee; D. W. R. Morgan, president-nominee; F. S. Blackall, jr., past-president; H. R. Kessler, vice-president; F. L. Bradley and R. B. Lea, directors; and C. E. Davies, secretary.

Foreign Dues Policy

The Committee voted that for countries other than Mexico, the following policy regarding payment of dues of members in foreign countries as approved on Nov. 25, 1945, be extended for another year:

1 That the Society adopt a policy requiring all dues to be paid in United States dollars.

2 If such payment becomes excessive, upon request the Society may put the foreign member on the suspended-dues' list without service from the Society until such time as the Society may require him to pay his dues.

3 That the young foreign student engineer who is in this country for one year may be permitted to pay the dues of a Student Member in order to have the privilege of receiving MECHANICAL ENGINEERING and attending meetings during his residence in the United States.

Research Contract

Report was made of a contract between the Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals and the Southern Research Institute on research on the properties of cast iron at elevated temperatures covering (1) softening tests, (2) stress-rupture and creep tests, and (3) thermal and shock tests.

The ASME has been authorized to serve as the Contracting Agent for contracts authorizing research for the Joint ASTM-ASME Committee.

Luis Giannattasio

Joseph Pope, who attended UPADI convention in São Paulo, Brazil, August, 1954, reported that at the last plenary session of the convention James M. Todd called upon Alex D. Bailey to read the citation prepared for Honorary Membership in ASME prior to formal presentation of the certificate to Luis Giannattasio. Mr. Pope reported further that Mr. Giannattasio was much affected and that "this was a demonstration of good will from a group of North American engineers and apparently was much appreciated by those from all the other attending countries."

Symbol and Slogan Contests

Selection of the winners of the symbol and slogan contests was approved. Certificates are to be awarded to the winners in the name of the Council and cash awards of $250 each to be presented to the two first-prize winners.

Roy V. Wright Lecture

Thomas C. Desmond, senator, State of New York, was approved as the Roy V. Wright Lecturer at the 1954 Annual Meeting. Mr. Desmond is chairman of the Committee on Affairs of Cities.

Resolution of Thanks

A Resolution of Thanks was voted in which the thanks and appreciation of the Society were extended to all who had contributed to the success of the 1954 Fall Meeting in Milwaukee, Wis., Sept. 8–10.

Amendments and Changes

The Secretary reported that the members of the Council unanimously approved, by letter ballot closing Sept. 7, 1954, the proposed communication to the members of the Society regarding the questions to be voted upon in connection with amendments to the Constitution and a change in Society policy dealing with the Nominating Committee.

Blackall Award

Formal tenders of an award, to be designated "The Blackall Machine Tool and Gage Award" from the Taft-Peirce Foundation and the Blackall Foundation were reported. The Committee voted to accept the deed of gift with deep appreciation and thanks and to request the Board on Honors to take early action to put the award into effect.

In a letter dated Aug. 20, 1954, addressed to the Society Mr. Blackall suggested the following citation to be read at an appropriate Society ceremony on each occasion when the award is made: "The Blackall Machine Tool and Gage Award, named for Frederick S. Blackall, jr., president and treasurer of The Taft-Peirce Manufacturing Company, who served successively as President of The National Machine Tool Builders' Association in 1952 and as President of The American Society of Mechanical Engineers in 1953, was established by the Taft-Peirce Foundation and the Blackall Foundation as joint donors in 1954. Its purpose is to stimulate a continuing interest on the part of machinery, tool, and gage engineers in the activities of ASME; and of ASME in the problems of machine tool, gage, and dimensional measuring instrument design and application."

New Engineering Societies Building

It was reported that the Committee of Five Presidents had not been able to meet during August or September. A task group of staff representatives of the five societies is preparing a factual statement on the problems raised by E. B. Robertson, chairman, Committee of Five Presidents, and the Real Estate Committee of United Engineering Trustees, Inc.

Certificates of Award

Certificates of Award were granted to the following retiring chairmen of Sections: Robert F. Haller, Atlanta; Harlan W. Hyde, Baltimore; Allen H. Jensen, New Orleans; Fay Brainard, Oregon; and Carl Handen, Mid-Hudson Subsection of Metropolitan Section.

The following retiring chairmen of Regional Committees were also awarded certificates: K. R. Daniel, Sections; and C. P. Capps, Student Branch, both of Region IV.

It was voted to transmit a letter of appreciation to R. H. McLain over the signature of the President, for his services on the Subcommittee of the Admissions Committee since 1950.

Joint Awards

The Secretary reported that the 1954 recipients of awards in which the ASME has joint sponsorship are as follows: Hoover Medal to Alfred P. Sloan, Jr.; Gantt Medal to Clarence Francis; and John Fritz Medal to Harry A. Winne.

John Fritz Birthplace

The Executive Committee, at its meeting on May 21, 1954, authorized payment of $200 toward a bronze plaque to mark the birthplace of John Fritz, provided the other three participating societies concerned took parallel action. Since that action the Society has been advised by the John Fritz Medal Board of Award that the entire amount for the plaque, $750, has been contributed by the Bethlehem Steel Company and therefore the ASME contribution is not required. (For a story on the dedication of the plaque see MECHANICAL ENGINEERING, October, 1954, page 862.)

Pressure-Vessel Research

It was voted to approve the request of the Welding Research Council for $500 for the support of the work of the Pressure Vessel Research Committee.

Benjamin Franklin Anniversary

The Society has been invited by the Engineers' Club of Philadelphia (Pa.) to join with other societies in sponsoring a celebration of the 250th anniversary of the birth of Benjamin Franklin in 1956. The institutions which participate can, if desired, plan their own celebration during the year and "all, where practical, can emphasize one theme of international significance during the week of Jan. 15, 1956." It was voted to authorize the appointment of an ASME representative on the Committee of Sponsors to celebrate the 250th anniversary of Benjamin Franklin's birth.

H. L. Whittemore

The death on July 11, 1954, of H. L. Whittemore was noted with regret. He served as Manager of the Society from 1930 to 1933.

Appointments

On recommendation of the Organization Committee, the Executive Committee approved certain appointments on Boards, Committees, and Joint Activities. (A complete list of appointments for 1954-1955 will appear in ASME Manual AC-10, "Personnel of Council, Boards, and Committees," to be issued early in 1955—Editor.)

The following presidential appointments were confirmed:

F. S. Blackall, jr., R. L. Goetzenberger, E. J. Kates, and C. E. Davies as 1955 representatives to the Engineers Joint Council; Thompson Chandler and R. B. Lea as alternates.

C. A. Hescheles, L. N. Rowley, Jr., and W. A. Shoudy as Tellers of Election of Officers.

M. E. Farris to AAAS International Arid Lands Symposium and Conference, New Mexico, April 26-May 2, 1955.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after Nov. 25, 1954, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

Key to Abbreviation

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member

New Applications

For Member, Associate Member, or Affiliate

ABEL, JOHN S., Tacoma, Wash.
ALEXIOU, THANOS, New York, N. Y.
ANDERSEN, ARTHUR O., La Crosse, Wis.
ARMSTRONG, CARL C., JR., Angleton, Texas
BARBARIN, MARCO P., Pompton Lakes, N. J.
BARNHILL, KENNETH G., Covington, Ky.
BELING, EARL H., Moline, Ill.
BLACKBURN, JOHN F., Belmont, Mass.
BORN, JAMES H., Oak Park, Ill.
BROWN, EDWARD C., JR., Lake Success, L. I., N. Y.
BUDDENHAGEN, THEODORE F., Williamsville, N. Y.
BURTT, JOHN E., Hamilton, Ohio
BUSH, REGINALD I., Library, Pa.
CARRICK, ROBERT C., Pittsburgh, Pa.
CATES, ERNEST W., Ridgeway, Va.
COCK, CALVIN E., JR., Corpus Christi, Texas
COLLINS, JOHN F., New Castle, Del.
CORTES, MEDERICO T., Manila, P. I.
CUNNINGHAM, GEORGE W., Walla Walla, Wash.
DEPUY, JAMES R., Midland, Mich.
DOMBEY, ROBERT L., Rocky River, Ohio
DOUTY, CLAUDE J., Pullman, Wash.
DUNKEL, WERNER E., Philadelphia, Pa.
EDWARDS, EVERETT B., Wantagh, L. I., N. Y.
ERICKSON, MELVIN H., Cincinnati, Ohio
ESTRADA, MANUEL C., Mexico, D. F., Mex.
FALKENBERRY, HAROLD L., Upton, L. I., N. Y.
FARLOW, CARL P., JR., Birmingham, Ala.
FARMER, JOHN R., Los Alamos, N. Mex.
FAUTH, EDWARD H., Aurora, Ill.
FAY, JAMES A., Ithaca, N. Y.
FERNES, EMIL F., Baltimore, Md.
FORSTER, JOHN O., Harrison, N. Y.
FRANKLIN, HENRY J., New Orleans, La.
GIANNUZZI, LOUIS N., Brooklyn, N. Y.
GILES, ERIC B., North Bay, Ont., Can.
GIVENS, HOMER C., Falfurrias, Texas
GLINDMEYER, RALPH W., Covington, Ky.
GRAMES, LLOYD D., Wellsville, N. Y.
GRANFORS, WILLIAM H., No. Syracuse, N. Y.
GRAY, B. EVERETT, St. Louis, Mo.
GREENE, GEORGE W., Lake Jackson, Texas
GREENHILL, CHARLES E., Livinsgton, N. J.
GUERNSEY, ROSCOE, JR., Schenectady, N. Y.
GUY, MILTON F., Detroit, Mich.
HAWN, HERBERT W., Houghton, Mich.
HENRY, WALKER H., White Plains, N. Y.
HERIN, WALTER B., Los Alamos, N. Mex.
HETHERWICK, ROY A., New Orleans, La.
HUBENTHAL, JOHN W., Chicago, Ill.
HUNT, KARL H., New York, N. Y.
ILES, FRANK B., Lumberton, N. J.
JACOBSEN, CARL E., Los Alamos, N. Mex.
JENKO, WILLIAM J., Endicott, N. Y.
JOHNSON, JAMES E., Huntsville, Ala.
KANE, THOMAS R., Drexel Hill, Pa.
KAROL, JOSEPH H., Whippany, N. J.
KARPUK, JOHN P., Louisville, Ky.
KEARNEY, JOHN J., New York, N. Y.
KEITH, CONRAD, Toledo, Ohio
KELLER, ROLAND C., San Mateo, Calif.
KELLY, ALDEN W., Youngstown, Ohio
KLEINTOP, HAROLD, E., Parkesburg, Pa.
KOENIG, ROBERT F., Schenectady, N. Y.
LAMBERT, EDWARD R., Kansas City, Mo.
LEARY, RAYMOND E., JR., Clifton, N. J.
LEGGETT, JOHN H., Union, N. J.
LEONARD, WILLIAM K., S. Charleston, W. Va.
LICENI, FRANCO, Buenos Aires, Argentina
LINGREN, ROBERT W., Chicago, Ill.
LITTLE, THOMAS E., Terre Haute, Ind.
LOONEY, ROBERT, Rochester, N. Y.
MARSHALL, RONALD R., Elmhurst, N. Y.
MAYNARD, MARVIN E., Chattanooga, Tenn.
MCGARRAH, ROBERT E., Ithaca, N. Y.
MCGILL, HOWARD L., Huntsville, Ala.
MCHUGH, JAMES D., Wilmington, Del.
MCVEY, ELDEN N., Hudson, Ohio
MEISOLL, ROBERT F., Brooklyn, N. Y.
MILLER, NATHAN H., Portsmouth, Ohio
MOFFITT, JAMES W., Aiken, S. C.
MOLIQUE, LAWRENCE G., Bartlesville, Okla.
MOODY, KENNETH J., Detroit, Mich.
MOORE, MICHAEL H., Melbourne, C. I., Australia
MOULDING, ELDON L., Santa Monica, Calif.
NEHRENZ, ALVIN F., Baltimore, Md.
NICHOLS, DONALD E., Cedar Rapids, Iowa
PEARSON, RAYMOND E., La Crosse, Wis.
PHELPS, HUGH B., Potsdam, N. Y.
PICKENS, ANDREW L., JR., Foley, Fla.
POHLE, FREDERICK V., Garden City, N. Y.
PURVIS, MERTON B., State College, Pa.
RANDOLPH, JOHN A., Honolulu, T. H.
REAST, WORTH M., Pensacola, Fla.
REECE, ROBERT H., San Luis Obispo, Calif.
RICHTER, JOHN K., Evans City, Pa.
RIELLY, WILLIAM R., San Francisco, Calif.
RISCH, PHILLIP W., Tulsa, Okla.
RITZI, EMIL, Manhattan Beach, Calif.
RIVAS, H., THOMAS, Los Angeles, Calif.
ROBINSON, JOEL D., Poughkeepsie, N. Y.
ROEDIGER, WALTER C., JR., Tucson, Ariz.
ROSENBERG, HANS K., Cincinnati, Ohio
ROSENCRANTS, EDWARD W., Minneapolis, Minn.
SANDERS, HENRY V., Concord, N. C.
SAVAGE, CHARLES F., Marblehead, Mass.
SCHACHTER, ZVI, Corry, Pa.
SCHLAG, CARL H., JR., Los Alamos, N. Mex.
SCHWARTZ, HILTON H., Fresh Meadows, N. Y.
SCOTT, OLIVER, Mexico, D. F., Mex.
SEATON, EARL A., JR., Tulsa, Okla.
SHEN, CHI N., Hanover, N. H.
SKIDMORE, KENNETH L., Houston, Texas
SLATER, JOHN G., Milwaukee, Wis.
SMAISTRLA, ROBERT N., Houston, Texas
SMITH, DILLON F., JR., Pensacola, Fla.
SMITH, LESTER W., New York, N. Y.
SMITH, RAYMOND V., Salt Lake City, Utah
SNIVELY, HOWARD D., Schenectady, N. Y.
SPARKES, CURTIS A., Altringham, Cheshire, England
SPEAR, GILMORE M., Rochester, N. Y.
STAJKOWSKI, LEON S., Chicago, Ill.
STIEHLER, ROBERT D., Washington, D. C.
THOMAS, CARL D., Falcon, Venezuela, S. A.
THOMPSON, JAMES A., Chattanooga, Tenn.
THORN, JAMES D., Lincoln, England
TITZEL, WILLIAM J., Pittsburgh, Pa.
VISSAT, PETER L., Chicago, Ill.
WALDRON, STODDARD S., New York, N. Y.
WALKER, RICHARD C., Richland, Wash.
WALKUP, NORRIS W., Tuscola, Ill.
WATERS, FRANK P., Mt. Kisco, N. Y.
WEBJORN, JAN E., Camden, S. C.
WEEKLEY, NORVELLE E., Pensacola, Fla.
WEINDLING, JOACHIM I., Rego Park, N. Y.
WEINER, JEROME H., New York, N. Y.
WETMORE, WILLIAM H., Evendale, Ohio
WHEELER, WILLIAM E., JR., San Antonio, Texas
WILDS, PAUL J., Levittown, Pa.
WINYARD, FREDERICK W., Sarawak, Borneo

WOODALL, AARON M., Birmingham, Ala.
YARD, JOB A., Yonkers, N. Y.
YOUNG, JOHN W., Baytown, Texas
ZARATE, FIDELISMO B., Zambales, P. I.
ZENN, PHILIP, Louisville, Ky.
ZIMMERMAN, MARTIN L., Mobile, Ala.

Change in Grading

Transfers to Member or Affiliate

ANGERMEIR, CHARLES W., Finleyville, Pa.
DANZIGER, MAX J., Sunnyside, L. I., N. Y.
KRILL, ARTHUR M., Denver, Colo.
LIEVSAY, CLAUDE, JR., Ventura, Calif.
MORGAN, CHARLES, San Diego, Calif.
PFRANK, JAMES F., Beech Grove, Ind.
RUTH, EARL, Stamford, Conn.
RYDEN, EDWARD F., Indianapolis, Ind.
SABERSKY, ROLF H., Pasadena, Calif.
SCHMIDT, ALFRED C., San Carlos, Calif.
SEIM, ORVILLE S., Elmhurst, Ill.
SINGLETON, JOHN C., Watchung, N. J.
THIES, AUSTIN C., Charlotte, N. C.
TOBY, IVON C., Pasadena, Calif.

Transfers from Student Member to Associate Member 160

Engineering Societies Personnel Service, Inc.

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members, or nonmembers and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th St.	84 East Randolph St.	100 Farnsworth Ave.	57 Post St.

Men Available[1]

Mechanical Engineer, 54, married; wide experience in engineering and designing automation equipment, production tools, special machinery (large and medium), material-handling and processing-plant layouts, plant engineering, and construction. Prefers Southwest. Me-133-095-D-San Francisco.

Research and Development Engineer, MSME; 29; seven years' experience includes tool and die design, engineering education and research, background in textiles and electronics; executive and administrative ability including technical reporting. Me-134.

Mechanical Metallurgist, 34; MS Mechanical, DSc Metallurgy; seven years' college teaching both fields; two years' design; three years' industrial research light metals; author technical papers. Registered Pa. Desires research and development. Me-135.

Chief Engineer, 36; BSME; registered PE; 15 years' experience in engineering, design, and development; organization and training of engineers and draftsmen; programming design and development. Desires engineering management position in New England. Me-136.

Mechanical Engineer, 15 years' machine-shop and maintenance experience; held positions of craft supervisor, and design and development engineer. Desires supervisory position in maintenance department or manufacturing plant. Me-137.

Mechanical Engineer, BME, January, 1953; 28; presently employed as liaison engineer supervising five engineers in researching assembly information on radar components; two-and-a-half years' experience as office manager. Desires challenging position with future. Me-138.

Construction Engineer, 30; married; BSEE and BSME; veteran; ten years' diversified experience in supervision, inspection of construction, and maintenance; circuit analysis, motor control, power distribution, system planning, plant layout, power plant, machinery installation, equipment testing, and handling personnel. Fluent Spanish; with knowledge of Italian, Portuguese, and French. Me-139.

Materials-Handling Packaging Engineer, 31; BSME; MSIE; six years' diversified experience, including supervisory, in all phases of handling and industrial packaging, comprising layouts, methods, design, testing, etc. Desires multiplant staff or sales engineering position. Me-140.

Plant Manager, broad and successful engineering and management background in metalworking industries. ME and IE degrees. Prefers New York metropolitan area. Me-142.

Executive Assistant, ME, MBA; 29, married; five years' experience in industrial engineering, mill management, and sales with leading textile concern. Desires position with more administrative responsibility. Me-143.

Mechanical Engineer, 41; extensive experience in automatic machine design, tooling and process equipment, supervisory experience. Desires permanent connections with medium-sized firm in metropolitan New York or lower Conn. Me-144.

Industrial Engineer, 31, married; four years' experience in methods, standards, quality control, and development work in synthetic textiles; two years' experience in industrial construction involving design and layout of process piping, heating, and ventilating systems. Desires permanent work in industrial-engineering field. Me-145.

Director of Development, Research, or Chief Engineer, PhD, ME 1942; mechanical, structural, plastics, or allied field; 20 years of diversified experience in transportation and aircraft; excellent record and references. Prefers small or medium-sized organization. Will deal with top executive only. Me-146.

Engineer, industrial, administrative, manufacturing; ME, MS, IE; 30; nine years' experience in textile, chemical, and metal-processing industries. Willing to travel. Me-147.

Industrial Engineer, MSIE, 34. Experienced in methods, works simplification, incentives standard, tooling, plant layout, cost analysis, production engineering. Seeks position where ingenuity and self-starting qualities are needed. Prefers northeastern U. S., but will relocate. Me-148.

[1] All men listed hold some form of ASME membership.

Positions Available

Chief Engineer, under 50, at least ten years' executive, administrative, and product-application experience in mechanical, electrical, chemical, and metallurgical fields, covering automotive and aircraft accessories. To $25,000. Ohio. W-281.

Chief Engineer, graduate mechanical, to supervise five to ten engineers and draftsmen; the design work involves semicustom designing of heavy bakery machinery from sheet-metal and structural-steel shapes. Must have a knowledge of processing of these materials, and knowledge of the principles of heat transfer and furnace operation. $8000–$10,000. Conn. W-284.

Engineers. (*a*) Mechanical engineering, not over 32, draft exempt, for position involving planning, scheduling of current construction, and forecasting of future projects; establishing work priorities, reviewing construction-material status, maintaining job-status reports. Producing operation assignment. Two-year contract with three-and-a-half months' vacation. $6000–$9000, depending on qualification; salary paid in American currency. Room and board furnished for single applicants; if married, after a period of approximately ten months, will be given residence allowance for quarters and living. Foreign. (*b*) Project or process engineer, not over 45, oil-refinery experience, for foreign assignment. Salary open. Far East. F-286.

Administrator of Mechanical Design, 35–45, engineering degree, at least ten years' experience in responsible charge of design and development engineering in the precision-machinery or electromechanical fields. Must understand design for production and have a background of experience covering quality and reliability of products. $10,000–$12,000. N. J. W-386.

Chief Engineer, 40–50, mechanical-engineering graduate, at least ten years' design, project, and executive-engineering experience on high-speed four-cycle diesel engines. $15,000–$20,000. East. W-411.

Plant Engineer, not over 50, plant-engineering and production experience in metal-products manufacturing fields, to supervise tooling, production layout, polishing, spraying, and general equipment maintenance including air conditioning, heating, etc. $10,000, plus bonus. N. J. W-425.

General Manager, mature, to organize production and co-ordinate sales for expansion for small concern manufacturing a component for electronic circuits, used by manufacturers nationwide. A precision product, the process of which involves controlled mix, press, and heat. Sales engineering and design to customer specification and marketing are factors. Apply by letter giving complete data, including number of employees supervised, and past salaries. Upper N. Y. State. W-432.

Production Engineer, at least five years' experience in the manufacture of insulated wire and cable, preferably experience in plastic insulations. Manufacturing experience is required in preference to design experience. Conn. W-438.

Personnel Consultant, under 60, engineering graduate, for job analysis, recruitment, and administrative duties with steel-products manufacturer on consulting or part-time basis. Retired engineer with design, manufacturing, and application experience preferred. Pa. W-457.

Chief Industrial Engineer, executive, administrative, and cost-reduction experience for textile-apparel manufacturer with multiplant operations in eastern states. $8000–$10,000. Headquarters, New York metropolitan area. W-491.

Mechanical Engineer experienced in the maintenance of heavy-duty trucks and other heavy-duty equipment. West. W-495.

Engineers. (*a*) Maintenance, planning, and scheduling engineer, 32–40, mechanical degree preferred. Should have experience in office engineering; systems and methods, possibly obtained in an accounting department; several years' practical engineering experience. Will develop programs, planning, analyzing, evaluating, and solving, planning, and scheduling engineering problems. Some experience in metallurgical ore-dressing or heavy chemical-plant equipment. $8000–$9000. (*b*) Plant-protection engineer, 28–35, education in industrial fire prevention and fire fighting, or equivalent. Administrative ability to handle guard force and porters. Should have potential in other industrial-relations functions such as labor relations, safety, employment, or training. Will train fire brigade of volunteers. $5520–$5610. La. W-504.

Engineers. (*a*) Maintenance superintendent, 35–45, mechanical or electrical, mechanical degree preferred, at least ten years' experience in maintenance supervision. Will have an elec-

(*ASME News Continued on page 960*)

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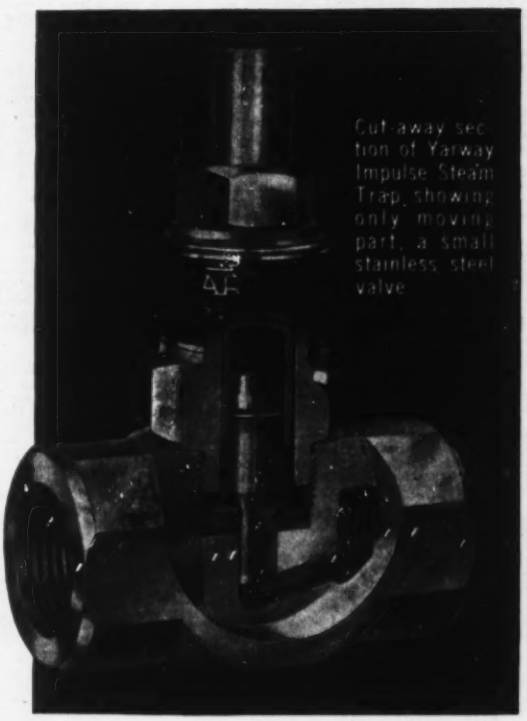

Cut-away section of Yarway Impulse Steam Trap, showing only moving part, a small stainless steel valve

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trical superintendent and a mechanical superintendent reporting to him. Detailed knowledge of metallurgical ore-dressing equipment and heavy chemical-plant equipment; experience in plants of these types preferred. Will have about ten supervisory subordinates and a crew of up to 450 men. $10,000–$12,000. (*b*) Maintenance superintendent, 35–40, graduate electrical, ten to 15 years' experience with electrical equipment, etc. Diagnostic ability. Will supervise several meter and instrument and electrical engineers, and a crew of 40 to 50 men. Minimum of five years' high supervisory experience. Some knowledge of electrical meter and instrument theory. $9000–$10,000. La. W-505.

Engineers. (*a*) Mechanical engineer, graduate, over five years' industrial-design experience, to act as consultant on all mechanical-engineering problems pertaining to design, manufacture, test, and operation, i.e., reciprocating and centrifugal compressors and pumps, diesel engines, heat-transfer equipment, etc. (*b*) Estimator, graduate, at least eight years' practical experience, to supply the sales department with an estimate of cost of equipment. Must have cost-estimating experience concerning the production and erection of processing plants, including chemical, petroleum refining, air separation, or other low temperature. Salaries open. Pa. W-508.

Engineers. (*a*) Project engineers, mechanical or chemical graduates, experience in chemical-plant process design, preferably in the low-temperature field such as air-separation plants, hydrogen or helium purification, or cryogenic processing of natural gas or other products. Experience in chemical-plant cost estimating desirable. Must be familiar with piping, construction, and engineering codes. Will be responsible for all aspects of the company's performance, including firming up of process details, supervision of engineering and drafting, design, and/or selection of equipment, etc. $7000–$10,000. (*b*) Process engineer, low-temperature process-engineering experience in the basic unit operations of heat exchange, fluid flow, adsorption, and distillation; experience should include the field of air separation. Knowledge of the application of low-temperature processing to such problems as helium recovery, hydrogen purification, separation of by-products from natural gas, and the general application of low-temperature techniques to other fields. $8000–$12,000. Pa. W-509.

Professor and Head of Mechanical-Engineering Department, graduate mechanical with doctor's degree, under 40, industrial and/or research experience, for newly organized mechanical-engineering department in an eastern college. Some consulting work possible. Salary open. W-514.

Machine-Shop Manager, 35–45, to assume complete responsibilities in planning and scheduling, training, dealing with incentives and standards, and responsibility for economic use of facilities. $6000–$9000. Pa. W-527.

Chief Development Engineer, graduate, experience in pulp and paper manufacturing and the application of pulp and paper-mill machinery and equipment to the manufacturing processes. This position requires the originating of ideas, procedures, and methods in the design and development of machinery. $7000–$8000. New England. W-528.

Engineers. (*a*) General sales manager, graduate engineer, for a medium-sized fabricator of pipe-expansion joints and steel fabricators of heat exchangers and other process equipment. Must have had some direct selling experience. Will co-ordinate operation of eight district offices and 40-odd sales agencies; co-ordinate advertising, sales-promotional literature, etc. About $15,000, with overriding bonuses based on net profits. (*b*) Engineer, graduate mechanical or chemical, 28–40, for a medium-sized fabricator of pipe-expansion joints and steel fabricators of heat exchangers and other process equipment to work up to chief engineer. Must be able to create thoughts and designs which have some sound basis and which can be manufactured economically. $10,000–$14,000, to start. Upstate N. Y. W-543.

Sales-Promotion Executive, 35–45, mechanical or civil graduate, sales, sales promotion, and application-engineering experience covering steel products for construction industry. Salary open. Pa. W-545.

Assistant Sales Manager and District Sales Manager, under 40, graduate engineers, sales experience covering hydraulic equipment, paper-mill machinery, valves, hoists, presses, and heavy-steel products. $8000–$12,000. Assistant sales manager, Ore.; District manager, New York, N. Y. W-553.

Product Engineer, mechanical-engineering degree, about ten years' experience in instrumentation or an allied field. Will be responsible for directing, designing, and testing electromechanical optical devices to military and/or commercial specifications. $8000. New England. W-577-(*b*).

Works Manager for plant with 1200 employees, fabricating heavy sheet metal and castings. Substantial company located in central region. $25,000. W-563.

General Manager, 35–50, for capital-goods manufacturer. Manufacturing and engineering strengths are sought rather than sales. May now be employed in the engine, heat-exchanger, pump-compressor, or related industry. $30,000. Chicago area. W-564.

Executive Vice-President for a very large manufacturer of heavy-mill, chemical, and other equipment of both special and standard design. Unusual opportunity. $50,000. Midwest. W-565.

Project Engineer, heating controls, mechanical or electrical graduate, 30–45, at least five years' experience in research and development in heating controls, oil, or gas. Knowledge of A.G.A. and Underwriters' requirements. Will develop and design heating controls for gas and oil burners. $7000–$8500. Employer will negotiate fee. Chicago, Ill. C-2199.

Assistant editor, BS(ME) to 35. Prefer a man with knowledge of general industrial methods and equipment and writing ability. Knowledge of publishing would be helpful. Will report on new or better industrial developments, edit technical articles, and prepare manuscripts for publication in company's publication. This means contacting engineers in industry, getting information from them, and preparing it for publication. $5000, and up. Employer will pay fee. Traveling but no car required. Mich. C-2213.

Project Engineer, graduate mechanical, 35–45, at least ten years' experience in design and development of flat-steel products. Will supervise draftsmen and junior engineers on design and development of flat-steel products. $7800–$9000. Northern Ind. C-2233.

Research and Development Engineer, Containers, graduate mechanical, at least ten years' experience in research and development in fiber and/or steel containers. Knowledge of the packaging field. Will head up department doing research and development work on fiber and steel containers. $12,000–$15,000. Employer will negotiate fee. Chicago, Ill. C-2270.

Experimental Aerodynamist, mechanical or aeronautical graduate, at least two years' experience in machine-shop practices and preferably estimating or processing fields. Will estimate cost of jobs for manufacturing aerodynamic instruments and testing and approving finished jobs. To $10,000. Employer will pay fee. Chicago, Ill. C-2274.

Development and Test Engineer, BS or MS degree in physics or electrical engineering. Will work on noise, vibration, and stress-analysis problems. Experience in the automotive field desirable. Salary open. Midwest. D-9570.

Obituaries . . .

Carroll Wesley Baldwin (1880–1954?), district manager, Power-Plant Division Sales Department, American Engineering Co., Philadelphia, Pa., died, according to a notice recently received by the Society. Born, Norristown, Pa., Sept. 6, 1880. Education, high-school graduate, 1907. Author of several technical papers on power which were published in professional journals. Assoc. ASME, 1947.

Ralph Edgar Curtis (1866–1954), retired engineer, Eastern Gas and Fuel Associates, Everett, Mass., plant, died at his home in Danvers, Mass., June 2, 1954. Born, Newburyport, Mass., Sept. 28, 1866. Parents, Francis and Laura A. (Senter) Curtis. Education, BS(ME), Massachusetts Institute of Technology, 1887. Married Magdalena J. van Wynen, 1900; children, Laurence D., Lois H., Elisabeth S. Jun. ASME, 1888; Mem. ASME, 1901. He served the Society as secretary, Boston Section, 1912–1914; chairman, 1914–1915.

Howard George Dorr (1907–1954), senior engineer, coated-fabric development division, The Firestone Tire and Rubber Co., Akron, Ohio, died July 19, 1954. Born, Sullivan County, N. Y., April 2, 1907. Education, graduate, Mechanics Institute, 1928; received Ohio State Board of Education diploma, 1946; attended Akron University; ICS courses. Held several patents on lifesaving equipment and rubber products. Jun. ASME, 1948; Mem. ASME, 1950. Survived by wife, Mrs. Lillian Dorr.

Ralph L. Feagles (1879–1954), consulting engineer, Oklahoma City, Okla., died June 4, 1954. Born, Oak Valley, Kan., March 31, 1879. Parents, David D. and Hannah J. Feagles. Education, Nickerson Normal College; BS, University of Kansas, 1908. Married Mary A. West, 1915; children, Robert W., Elizabeth J. Mem. ASME, 1912. He held four patents pertaining to containers.

Frank Davis Gregg (1899–1954), manufacturers' representative, Los Angeles, Calif., died Aug. 6, 1954. Born, Philadelphia, Pa., April 29, 1899. Education, ME, Cornell University, 1927. Jun. ASME, 1928; Assoc-Mem. ASME, 1934; Mem. ASME, 1935. Survived by wife, Neola Gregg, and brother, Morris Gregg, New York.

John Coyne Hardgrave (1888–1953), professor, mechanical engineering, Texas Technological College, Lubbock, Texas, died Dec. 25, 1953. Born, Micanopy, Fla., Jan. 12, 1888. Parents, Oliver and Sophie (Littlejohn) Hardgrave. Education, high-school graduate; correspondence courses in mechanical engineering, air brakes, and personal efficiency. Married Aline Roberts, 1910; children, Robert Lyle and Bascomb Lynn (twins), Sophie Alice. Assoc-Mem. ASME, 1930; Mem. ASME, 1935.

Benjamin Musser Herr (1883–1954), owner, Herr-Harris Co., Pittsburgh, Pa., died June 20, 1954. Born, Lancaster, Pa., July 15, 1883. Parents, Allan A. and Annie (Musser) Herr. Education, Millersville Normal School; Franklin and Marshall Academy; ME, Cornell University, 1902. Married Mary Warren Brown, 1914; children, Benjamin M., Jr., and Katherine Laetitia (Mrs. Frederick H. Parkin). Mem. ASME, 1915.

George X. Johnston (1872–1954), retired machinist, died July 21, 1954. His home was in St. Clair, Mich. Born, South Haven, Mich., Sept. 20, 1872. Education, district schools; ICS courses; and Armour Scientific Academy. Married Adele Fullenwider, 1915. Assoc-Mem. ASME, 1927; Mem. ASME, 1935. Survived by wife.

Henry Russel Kent (1866–1954), former president of Henry R. Kent & Co., Rutherford, N. J., died Aug. 4, 1954, at his home in South Chatham, Mass. Born, Brooklyn, N. Y., Feb. 1, 1866. Parents, Edward and Artimesia S. Kent. Education, graduate of Brooklyn Collegiate and Polytechnic Institute. Married Maud Dickinson, Feb. 9, 1893. Mem. ASME, 1901. Survived by wife; two sons, Frank D., Ridgewood, N. J.; Lewis S., Chatham, Mass.; six grandchildren and two great-grandchildren.

Daniel Tate MacLeod (1873–1954), retired engineer, died at Longmeadow, Mass, June 25, 1954. Born, Canton, Mass., April 3, 1873. Education, attended several Cambridge, Mass., schools; special courses in mathematics, chemistry, and engineering. Assoc. ASME, 1901; Mem. ASME, 1907.

Harry Bowman Marsh (1872–1953), market consultant in the automotive field, died Nov. 16, 1953, at his home in Hagerstown, Md. Born, Muncie, Ind., April 30, 1872. Parents, Henry C. and Mary A. Marsh. Education, BS (EE), Purdue University, 1896. Married Eleanor M. Lockwood, 1897 (died 1945). He was past-president and founder of the Market Research Club of Indianapolis, Ind. Mem. ASME, 1918. Survived by son, Robert L., Glencoe, Ill.; daughter, Mrs. M. Elizabeth Hayman, St. Louis, Mo.; three grandchildren; and sister, Mrs. Hattie Ripley.

Gerhardt John Patitz (1876–1954), chief engineer until 1946; the engineer who designed and supervised the construction of many buildings for Standard Brands, Inc., New York, N. Y., in this country, South America, and Cuba; died in Peekskill, N. Y., Aug. 9, 1954. Born, Muegeln, Germany, Oct. 27, 1876. Parents, Frederick A. and Marie Selma (Boehme) Patitz. Education, graduate, Dresden, Germany, Technical College, 1893; postgraduate study at Milwaukee, Wis., Engineering College. Naturalized U. S. citizen Chicago, Ill., Sept. 26, 1906. Married Ella T. Vogt, 1908 (deceased). Author of several published technical papers and was granted a number of patents pertaining to refrigeration, fermentation, distilling, and drying. Served as commissioner on Board of Water Commissioners, Peekskill, N. Y., for six years. Jun. ASME, 1900; Mem. ASME, 1907. Survived by two sons, Erhardt N. and Roland O.

(*ASME News Continued on page 962*)

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Olaf Leonhard Riegels (1877–1954), consulting engineer, Cleveland, Ohio, died June 17, 1954. Born, Oslo, Norway, July 31, 1877. Parents, Johan S. and Inga M. (Bergh) Riegels. Education, ME, Horten Technical College, 1899. Naturalized U. S. citizen, New York, N. Y., March 3, 1931. Married Ellen Brockdorff Sönderup, 1907; child, Elling. Held several patents for engine-starting devices, fuel-injection systems, fuel pumps and distributors, and wrote many papers on these subjects for publication in the U. S. A. and abroad. Mem. ASME, 1927.

Carl Lorenz Siegel (1903–1954), mechanical engineer, The Atlantic Refining Co., Philadelphia, Pa., died May 25, 1954, at Sacred Heart Hospital, Norristown, Pa. Born, Burlington, Iowa, March 29, 1903. Parents, Charles W. and Anne M. Siegel. Education, BSME, Iowa State College, 1925. Married Margaret L. Johnston, 1927; children, Robert and William. Author of several technical papers on heating and ventilating, oil refining, distillation, heat exchange, and general plant construction. Jun. ASME, 1937; Mem. ASME, 1940.

Irwin M. Slote (1921–1954), project engineer, Design-Engineering Division, Solar Aircraft Co., San Diego, Calif., died Aug. 19, 1954. Born, Poughkeepsie, N. Y., Aug. 3, 1921. Education, BME, Rensselaer Polytechnic Institute, 1942. Jun. ASME, 1942. Survived by wife, Adele; and three children, Mark, Janet, and Craig, all residing in Claremont, Calif.

George Edwin Stevens (1898–1954), engineer, B. Offen & Co., New York, N. Y., died Aug. 17, 1954. Born, New York, N. Y., March 11, 1898. Parents, Nelson M. and Adah Stevens. Education, BS(ME), Tri-State College, 1923. Married Alice Rayner, 1923; daughter, Alice C. Jun. ASME, 1943.

George Hathaway Taber, Jr. (1890–1954), oil executive and a former president, Sinclair Refining Co., died at his home in Rye, N. Y., on Aug. 20, 1954. Born, Franklin, Pa., Jan. 4, 1890. Parents, George H. and Elizabeth (Fessenden) Taber. Education, BS(ME), University of Pennsylvania, 1911; MS(ChE), Massachusetts Institute of Technology, 1913. Married Elizabeth I. Brown, 1917. Jun. ASME, 1918; Mem. ASME, 1930. Holder of several patents on petroleum refining. Survived by wife; a son, George H. Taber, 4th; and a daughter, Mrs. Anthony B. Cudahy.

John F. Taddiken (1884–1954), vice-president and general manager since 1935, The Honolulu Iron Works Co., Honolulu, T. H., died May 24, 1954. Born, St. James, La., Feb. 15, 1884. Education, BE, Tulane University, 1906. Jun. ASME, 1907; Mem. ASME, 1923.

John F. Vaughan (1872–1953), retired consulting engineer, Belmont, Mass., died Dec. 17, 1953, according to a notice recently received by the Society. Born, Cambridge, Mass., Sept. 13, 1872. Parents, Charles E. and Elizabeth F. (Wells) Vaughan. Education, BS(EE), Harvard Engineering School, 1895. Married Ellen T. Batchelor, 1902; children, Elizabeth F., George B., Charles, and J. Hallowell. Mem. ASME, 1917. Held several patents on flowmeters and map-meters.

William Morgan Wade (1896–1954?), whose death was recently reported to the Society, was chief engineer, Westfield (Mass.) State Sanitorium. Born, Westfield, Mass., April 2, 1896. Parents, Edward T. and Amelia A. (Humes) Wade. Education, high-school graduate; college credits acquired through college extension courses. Married Arlene MacKnight, 1902; daughter, Jean Catherine. Was awarded a certificate of merit by the National Association of Power Engineers.

William Barker Wait (1886–1954), retired plant engineer, American Sugar Refining Co., New Orleans, La., died July 17, 1954, at his home in Watkins Glen, N. Y. Born, Watkins Glen, N. Y., July 8, 1886. Parents, William H. and Mary E. (Wickham) Wait. Education, ME, Cornell University, 1908. Married Ella F. Bradley, 1910; children, Mary E., William B. Jun. ASME, 1914.

Alpheus Fuller Williams (1874–1954), chairman, Alpheus Williams & E. G. Dowse, Ltd., Germiston, Transvaal, S. Africa, died Jan. 6, 1954. Born, Oakland, Calif., June 21, 1874. Education, BS, University of California, 1898. Assoc. ASME, 1900.

Lucien Ingraham Yeomans (1878–1954), Chicago, Ill., consulting engineer and a nephew of President Grover Cleveland, died in Chicago, Aug. 16, 1954. Born, Walworth, N. Y., April 3, 1878. Parents, L. T. and Susan (Cleveland) Yeomans. Education, Walworth Academy, 1885–1893. Married Florence L. Osborn, 1902. Married 2nd, Mary Edna O'Hara, 1921. Awarded the John Scott Legacy Medal by The Franklin Institute, 1918, for method of machine design. Holder of more than 50 U. S. Patents. Mem. ASME 1943. Survived by wife; a daughter, Ann; and a son, Lucien O., Babylon, L. I.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions' enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting this information is printed on this page. Please use it to keep the master file up to date.

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Nature of work done .....

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☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

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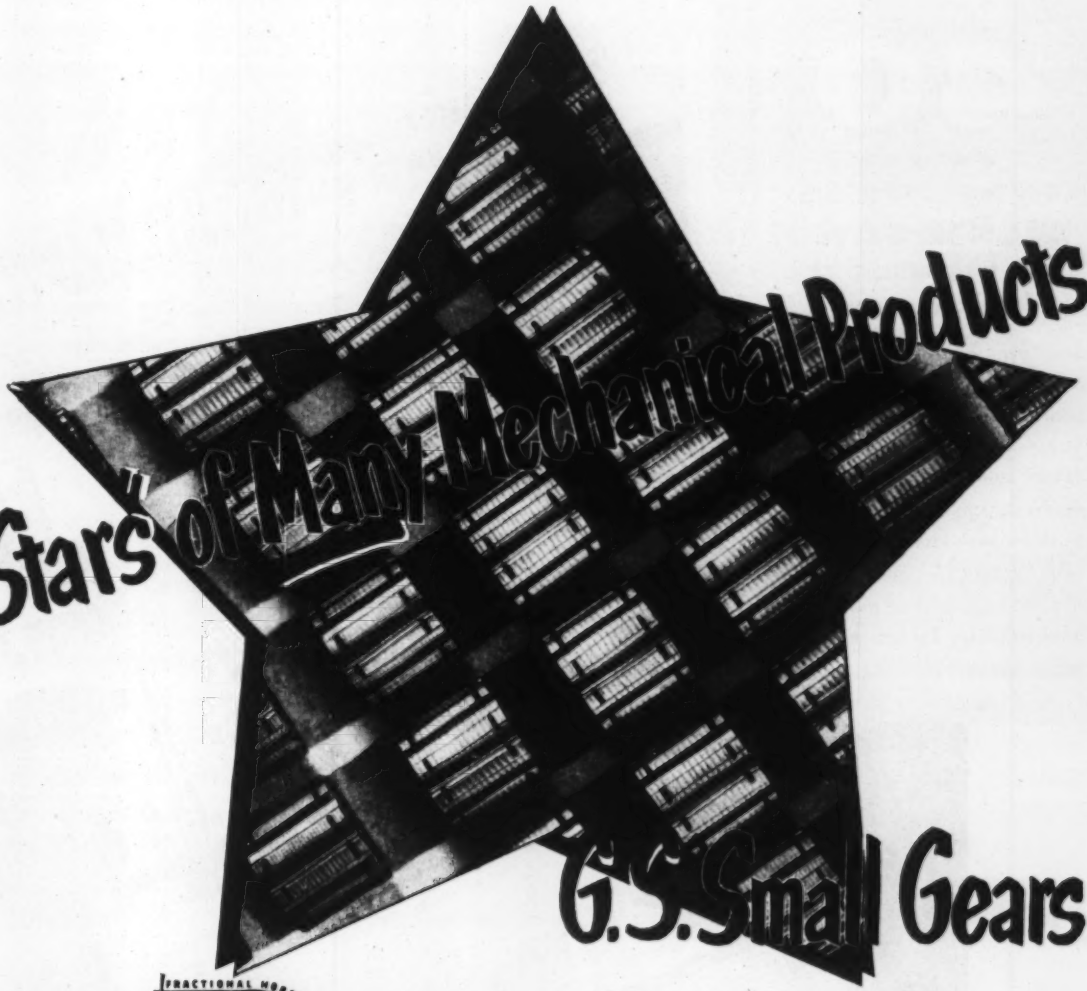

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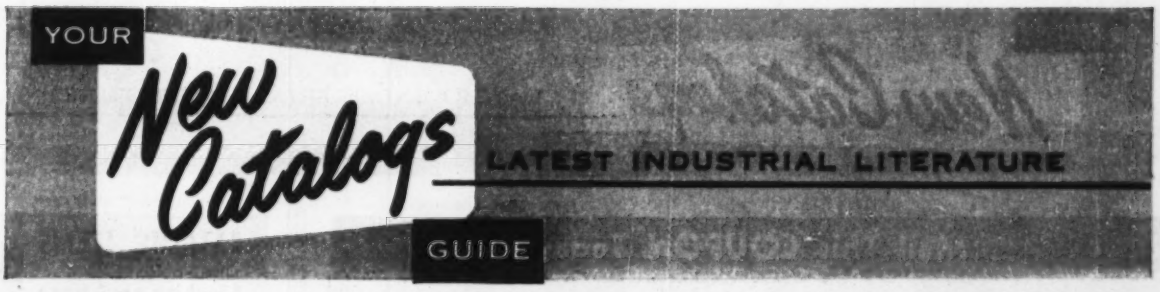

Those in industry who are responsible for various phases of plant, machinery, and product design, production, operating and application engineering will find much to interest them in this NEW CATALOGS Guide. Here, reputable manufacturers, most of whom have current advertising in MECHANICAL ENGINEERING and MECHANICAL CATALOG, offer to send you without obligation, their latest literature which is described on pages 45 to 87.

FOR convenience in locating catalogs about particular equipment, product or service, a list is given below in which the numbers refer to the catalog items beginning on page 45. This will aid you in locating something specific although a persual of the entire list may disclose other items of more than usual interest to you.

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1 HIGH-STRENGTH STEEL

U.S. Steel Corp.—A 48-page, 2-color booklet describes the company's new Carilloy T-1 steel, developed to meet the need for a steel, primarily in plate form, possessing a very high yield strength (90,000 psi or more) yet tough enough to withstand unusual stresses and pressures as well as shock at either low or high temperatures. The steel is described as readily weldable without preheating or stress relieving. The booklet gives complete technical data on the material's properties and fabrication, illustrated by tables, diagrams and photographs. Also included are application pictures, diagrams, and case histories of the use of the steel in pressure vessels, mining and earth moving, industrial and construction equipment.

2 FAN EQUIPMENT

Clarage Fan Co.—Illustrated 4-page bulletin describes new Type XL Fan for industrial air and material handling. Covers entire size range—11 through 60 in. inlet diam, pressures to 18 in. SP, volumes to 130,000 cfm.

3 RETAINING RINGS

Waldes Kohinoor, Inc.—A new 8-page catalog supplements the company's 52-page catalog covering Waldes Truarc retaining rings. The two catalogs include 33 pages of engineering and specification charts, 6 pages of field applications and case histories, 20 pages devoted to Truarc pliers, assembly, and accessory tools, and other relevant information pertaining to the most advantageous use and selection of the rings.

4 POWER TRANSMISSION

Boston Gear Wks.—Catalog NP-55, pocket-sized 196 pages, lists the company's new products including spur gears, gear gages, sprockets and chains, chain breaking tool, couplings, pillow blocks, flanged cartridges, bearings. This catalog is a supplement to the company's 384-page tab-indexed book which lists 101 power transmission groups of items immediately available from stock. Thirty pages of engineering data are included in the main catalog to simplify drive calculations.

5 ALUMINUM FORGINGS

Aluminum Co. of America.—A 171-page book, "Designing for Alcoa Forgings," outlines forging processes and shows how they affect various problems and principles of design. Recommended forging design proportions are given in tables and illustrated by specific examples.

6 THERMISTORS

General Electric Co., Carboloy Dept.—Technical Data sheets TH-9, discusses thermistors in application to time delay, oil burner circuit and controlled automation. Manufacturing and operating data plus grade selection. TH-10 describes temperature compensation, resistance range, application, advantages. TH-11 deals with contactless switches.

7 ELECTRIC POWER DRIVES

Sterling Electric Motors—The company's 12-page catalog of electric power drives contains cut-away drawings illustrating the various features of its variable speed and slow speed gear reduction units, and its totally enclosed and splash-proof electric motors. Mounting and control information is also included.

8 CENTRIFUGAL BLOWERS AND EXHAUSTERS

U. S. Hoffman Machinery Corp.—New Bulletin A-932 describes design and performance features of the Hoffman multi-stage centrifugal blowers and exhausters for 1 to 9 psi pressures or vacuum from 2 to 12 in. of mercury. It lists 17 industrial applications including several on which savings can be made by replacing high-cost compressed air formerly considered necessary. Also included are typical performance curves and data check lists for optimum blower or exhauster specifications.

9 ROLLER CHAINS, SPROCKETS

Acme Chain Corp.—Revised edition catalog gives specifications of American standard roller chains. Engineering section contains hp charts and tables for proper selection of roller chain drives and methods of installation and lubrication. Diagrams and photographs of actual installations are included.

10 MATERIALS HANDLING

Western Gear Works—Bulletin on "Tug-Bar." Crated, skidded or wheeled loads are easily pushed or pulled by means of traction applied to the pow-

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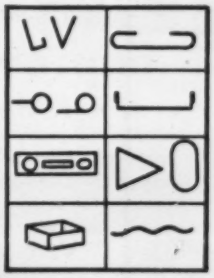

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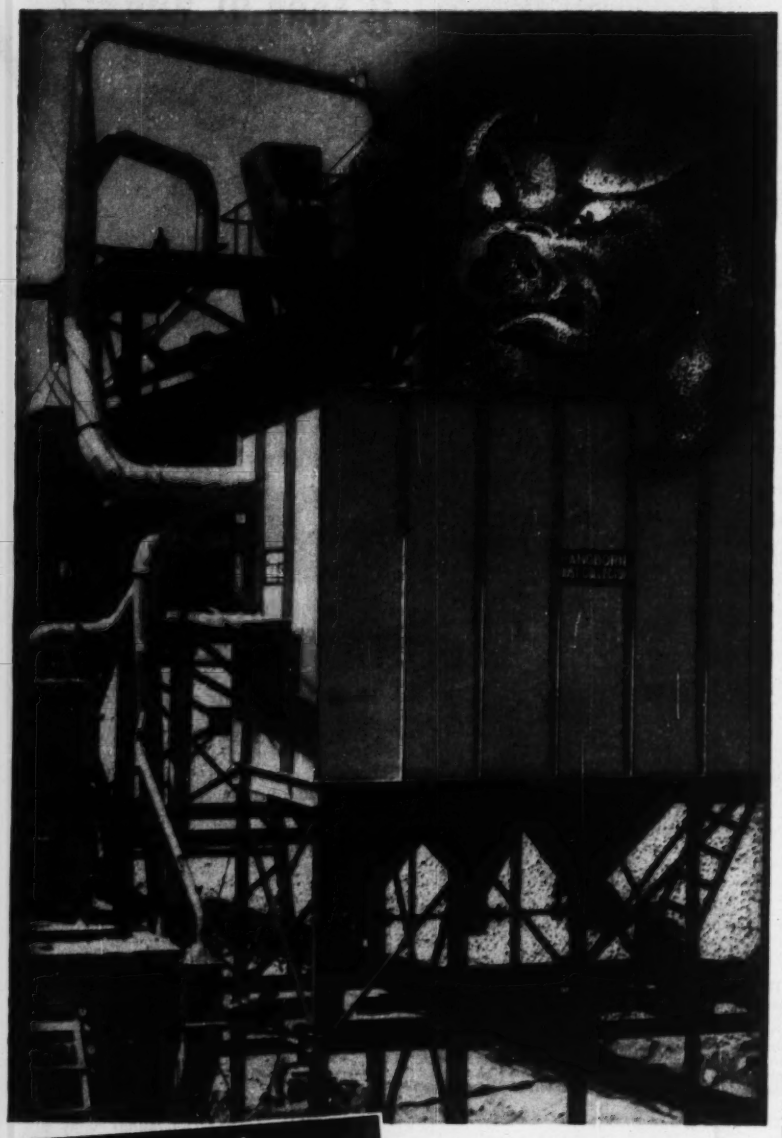

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ered front wheels. Tug-Bar is used in loading trucks, trailers, freight cars, steamship holds, aircraft, moving mail trucks and other non-powered portable freight trucks, etc. Available with 110 v a-c 60 cycle or 24–28 v d-c motors.

11 GAS TURBINE ELECTRIC POWER PLANTS

Westinghouse Electric Corp.—Catalog B-5859 contains complete information on design features, operation, engineering and performance data, dimensions, weight, selection factors and applications on the following units: 1800 hp; 5000 hp; 5300 hp; 7000 hp of combustion gas turbine power plants for mechanical drive applications. For engineers in the gas transmission, chemical, refinery, process and steel mill industries.

12 UNIT HEATERS

American Blower Corp.—Bulletin 7517, an illustrative catalog covers the newly designed line of American Blower unit heaters for steam and hot water applications. Both hofizontal and vertical type unit heaters are described and illustrated completely. The catalog also includes engineering data, complete rating and dimension tables, wiring and piping diagrams.

13 WELDED STEEL TUBING

Armco Steel Corp.—Catalog of welded steel tubing covers fabrication including cutting, deburring, bending, swaging. Also listed are sections on special tube-end forming machines, punching and notching, drilling, joining, cleaning and finishing. Illustrated with photos, drawings, charts, 4 pages.

14 FILTERS

Cuno Engineering Corp.—A 6-page Bulletin No. 053 (formerly 1148-PJL) gives complete data on Cuno Auto-Klean filters—edge filtration plus positive mechanical cleaning; Cuno Flo-Klean filters—backwash filter cleaning with no loss of fluid; Cuno Micro-Klean filters—replaceable element micronic filters. Description of models for industrial filtration installations are included.

15 STEAM-GENERATING EQUIPMENT

Kewanee-Ross Corp.—The 32-page Kewanee General Catalog 80 gives full description and complete data on entire line of boilers, boiler-burner units, and other equipment for heating, power, or process steam. It includes diagrams of small residential types up to large industrial sizes of 304 hp, for steam or water, high or low pressure, mechanically fired.

16 BRASS MACHINABILITY

Titan Metal Mfg. Co.—Machinability of free-cutting brass is compared with that of leaded steel in a 48-page illustrated booklet. The booklet reports results of extensive, closely controlled laboratory tests as well as results of six-month production runs manufacturing booster bodies from brass and leaded steel. Photos include microstructure of the materials, and progressive wear on turning tools used to machine brass and leaded steel in tests.

17 V-BELT DRIVES

Allis-Chalmers Mfg. Co.—Bulletin 20B6051 carries the procedure for figuring "Texrope" V-belt drives by means of tables, together with examples of how to use the engineering information given. The bulletin also describes "Texrope" belts, sheaves, and speed changers.

18 INDUSTRIAL INSULATION

Armstrong Cork Co.—A 32-page illustrated booklet includes specifications for industrial low-temperature and heat insulation. It explains and illustrates insulation products and sundries, and the application of insulation materials −300 F to 2800 F. Design data, standards, and methods of construction are described.

19 MECHANICAL SPRINGS

Associated Spring Corp.—"The Mainspring," the house organ of its ten divisions, is offered. It contains articles of scientific and practical interest prepared for engineers, designers, and users of mechanical springs. Published bimonthly.

20 PUMPS

Johnston Pump Co.—A series of seven bulletins containing engineering and design data covers vertical pumps for diesel fuel, gasoline, crude oil, LP gases, ammonia, turbine pumps, sump pumps, gasoline dispensing pumps and propeller pumps.

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21 RECEIVER RECORDER

Bailey Meter Co.—Product Specification P11-5 illustrates and describes new receiver recorder as providing one to four continuous chart records of any measured variables which may be converted to pneumatic signals. Also features a section on selection of the proper recorder for various applications.

22 HYDRAULIC OIL POWER EQUIPMENT

Vickers Inc.—Catalogs 5002A and M-5101 contain general design information and specifications of a complete line of pumps, valves, controls, and related equipment for oil hydraulic power transmission in machine tool (general industrial field) and mobile equipment industries, respectively. Individual units, also standardized or custom-built power units, transmissions, and control panels.

23 SELF-ALIGNING COUPLINGS

Koppers Co., Inc., Fast's Coupling Dept.—Six-page folder on Fast's self-aligning couplings gives graphic illustrations of principles and features of these couplings; table of utility factors for various kinds of connected machines; and tables of rating for standard forged-steel couplings and heavy-duty-type couplings.

24 BRASS ALLOY

American Brass Co.—"Formbrite" is a fine-grain brass alloy described in Publication B-39, which gives some of its industrial applications and advantages. Advantages claimed for the metal are strength, hardness, springiness, and surface superior to ordinary drawing brasses.

25 COLOR IN INDUSTRY

Pittsburgh Plate Glass Co.—The scientific utilization of energy in color to promote efficiency in industry is described in a 42-page, 4-color illustrated booklet. The use of color as applied to walls, ceilings and machines to decrease eye fatigue and help promote less absences and injuries is discussed. The company's specification service and how it can be obtained by industry is outlined, along with various materials specification charts.

26 POWER REDUCERS, GEARING

Foote Bros. Gear & Mach. Corp.—Engineering manual LP catalogs full line of Line-O-Power reducers featuring company's Duti-Rated Lifetime gearing said to be adaptable for wide range of applications. New design features are introduced and data on construction, selection, dimensions and hp ratings are listed.

27 STEAM ACCUMULATOR

Foster Wheeler Corp.—An illustrated 8-page bulletin explains the advantages, principles, and applications of the steam accumulator. In addition to instructions on how to calculate required capacity, the booklet includes a full discussion of the practical application of accumulator theory.

28 ULTRASONIC TESTING REFLECTOSCOPE

Sperry Products, Inc.—Bulletin No. 50-105, describes applications of ultrasonic testing techniques to manufacture, non-destructive product and materials examination, quality control, and preventive maintenance through utilization of the Sperry Reflectoscope. Capable of revealing defects through 30 feet of aluminum or steel, the instrument is available by purchase, lease, or engineering service.

29 CENTRIFUGAL PUMPS

Pacific Pumps, Inc.—A 4-page folder gives ratings and operating characteristics of 28 pumps. Information tabled includes temperature, capacity, pressure and differential head. The bulletin also describes two models of a turbo Boiler-feed pump.

30 SPRING ENGINEERING

American Steel & Wire Co.—A manual of spring engineering, replete with technical data and descriptive material. Contains general information on springs, materials, design of various types of springs and many tables covering the subject from practically all angles. Illustrated.

31 INDUSTRIAL FASTENERS

Thompson-Bremer & Co.—Bulletin covers 21 types of lock washers, also terminals, lock nuts, railroad floor clips and applications. Various finishes, type description with tables of data required for selection. Price list. Illustrated.

32 SPEED-MEASURING INSTRUMENTS

James G. Biddle Co.—Bulletin 35-50 describes resonant reed, centrifugal, and chronometric types of speed-measuring instruments, with 28 pages devoted to the selection, operation, and illustration of Frahm, Jagabi, Jones, and Dr. Horn instruments. Also featured are repair and engineering services available.

33 PILLOW BLOCKS

Fafnir Bearing Co.—The 4-page illustrated folder describes a new low-cost, light-duty ball-bearing pillow block with separable two-piece pressed steel housing. Exploded views, suggested applications, available sizes, dimensions, and load ratings are shown.

34 BALL BEARING SWIVEL JOINTS

Chiksan Co.—A new 32-page catalog, G-4, covers the company's line of ball-bearing swivel joints, loading racks, manifolding lines, all-metal marine and barge hose, and flexible aricraft assemblies. Typical industrial applications are illustrated and dimensional and operating data is provided.

35 ELECTRIC HEATING UNITS

Edwin L. Wiegand Co.—Catalog 50 covers specifications, construction details, application data, and prices of their complete line of electric heating units. Models are available with strip, ring, tubular, and cartridge heating elements. Also described are immersion, circulation, radiant, and forced-air duct heaters. Charts and tables are provided for selection of the various units.

36 INDUSTRIAL RUBBER

Roth Rubber Co.—Bulletin describes parts made from natural rubber, Neoprene, Buna N, GR-S, Butyl, Thiokol and Silicone. More than 700 stocks covering temperature, oil and fuel, chemical resistant, rubbers to laminate or bond, silicone and sponge. Molded, extruded or die-cut parts. Sampler available showing various types of hardness.

37 CONDENSER CIRCULATORS

C. H. Wheeler Mfg. Co., Economy Pumps, Div.—Catalog G-1154 describes double suction pumps to 54 in.; axial and mixed flow to 150,000 gpm. Designs are available for all conditions, cast or fabricated, with special materials for sea water. "Pull-out" type is also available.

38 THREAD INSERTS

Heli-Coil Corp.—Condensed catalog on the complete line of Heli-Coil screw thread inserts—for the protection and repair of tapped threads in all materials—is contained in new Bulletin 708. Covered are drilling and tapping recommendations, installation procedures, and specifications for classes, 3, 3B, 2, and 2B thread fits.

39 HEAVY DUTY FANS

Robbins & Myers, Inc., Propellair Div.—Bulletin 650, 12 pages, describes the company's type CSB and CSBV drumless duct fans and type CS and CSV tubeaxial fans for heavy duty applications. Tables on dimensions, performance and velocities are listed, along with a chart on duct resistance and data on open surface tank ventilation, system ventilation bearing assemblies, cooling problems, drying problems and general fan characteristics.

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The introduction of LUBRIPLATE Lubricants established a new high standard for industrial lubrication. Now, a recently patented improvement in the production of LUBRIPLATE results in even greater lubrication efficiency. Under today's operating costs, reduction of down time, less parts wear and replacements, as well as lower power consumption, far outweigh any differential in the initial cost of LUBRIPLATE Lubricants.

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New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

40 PACKAGED BOILERS

Bros Boiler & Mfg. Co.—Booklet No. WT-7 includes information on operation and specifications on types 1, 2, and 3 packaged boilers, built to meet steam requirements from 4100 to 30,000 lb per hr. Engineering data, diagrams and photos included.

41 GRATING-FLOORING AND TREADS

Irving Subway Grating Co., Inc.—Catalog F-225 contains illustrations, descriptions and engineering data on grating-flooring, treads, and floor armoring (riveted, press-locked, welded types) for industrial and power plants and refinery walkways, stairways, driveways, trucking aisles; ship cat-walks and engine room floors and treads; locomotive, freight and passenger car runways and treads; roadway armoring expansion joints, catch basin covers; bridge decking.

42 RIGHT ANGLE VERTICAL GEAR

Farrel-Birmingham Co.—New 4-page bulletin No. 456 contains instructions on selection of speed reducer or speed increaser in right angle vertical gear units. Also included are general specifications, hp ratings, dimension diagrams and table. Also offered is bulletin No. 449 on geared speed reducers, and No. 448-A on speed increasers.

43 BALL SCREWS

Vard, Inc.—Catalog No. 1001 illustrates and describes the company's ball screw line. Data on efficiency, standards and life expectancy of the units are included.

44 GLASS FIBER INSULATION

Glass Fibers Inc.—A 4-page illustrated booklet outlines the advantages of Microlite glass fiber insulation, a low-density, resilient insulating material with high thermal-efficiency and sound-absorption characteristics. It is described as being resistant to heat, fire, moisture, and corrosion and the company recommends its use in applications where the greatest thermal and acoustical efficiency is desirable in the smallest space. Tables are included on thermal and acoustical performance.

45 ADHESIVES

Minnesota Mining & Mfg. Co., Adhesives & Coatings Div.—Most important adhesives, coatings and sealers produced by 3M are listed in 8-page bulletin for quick determination of the type of product best suited to a particular manufacturing operation. Typical applications are illustrated and tabular listings quickly show technical data necessary for customer selection.

46 MINIATURE BALL BEARINGS

Landis & Gyr, Inc.—Design data on pivot, angular contact, radia, Filmoseal, roller, and special miniature ball bearings is listed in 2-color, 12-page booklet. Included are tables on bearing, housing and shaft tolerances, housing and shaft fits, and limiting speeds. Mounting procedures are described.

47 FLOW METERS

Foxboro Co.—Bulletin 460 describes basic flow meter advances and introduces six meter types for sustained accuracy in fluid flow measurement. Bulletin 465 on "Circular Case Automatic Controllers" and Bulletin 461 on "Automatic Controllers" cover other recent developments in Foxboro's line of pneumatic, electric, and electronic instruments for indicating, recording, and controlling industrial process variables.

48 PRECISION CHECK VALVES

James-Pond-Clark—A 4-page bulletin describes and illustrates the company's Circle Seal check valves. Included are specifications and technical characteristics on the company's standard, ultra-sensitive, standard aircraft and low pressure aircraft valves. The company has also issued three data sheets on a shutoff valve for liquid or gas service, in-line relief and industrial style valves.

49 FULLY CROWNED GEARED TEETH

American Flexible Coupling Co.—Seven major engineering advantages of fully crowned teeth in gear-type flexible couplings are described in a new Bulletin No. 1052. Excessive offset or angular misalignment, space limitation, high speeds, and torque loads are problems described and illustrated.

50 METAL BENDING

O'Neil-Irwin Mfg. Co.—The 32-page bending manual contains information on a wide variety of forming operations. The bending of tubing, angle, channel, and extrusions as well as solid materials is graphically illustrated. Detailed prints show the exact manner in which any rotary-type bending machine can be tooled for precision bending. The manual outlines the recommended steps in designing parts to be formed, choice of materials, and selection of bending equipment.

51 COMPUTING DIFFERENTIALS

Sperry Corp., Ford Instrument Co. Div.—Precision single spider gear differentials for uses in military and commercial computers described in 4-page brochure. Performance curves, specifications, dimensions, and descriptions of 1/8 in., 1/4 in., 3/16 in., and 5/16 in. differentials. The company also makes specials to customer requirements.

52 HEAT EXCHANGERS

Superior Combustion Industries, Inc.—Heat exchangers for heating and cooling, condensing and evaporating services, in relation to their use, are presented in an 8-page catalog. Cross sections of heads, shells and tube bundles together with brief descriptions and recommended applications are given. ank heaters and fuel oil heaters are also described.

53 SELF-ALIGNING BEARINGS

South-west Products Co.—Engineering manual No. 551, 21 pages, describes the company's Monoball self-aligning bearings and rod end bearings. The manual contains detailed prints, tables of capacities, and specifications on materials, finishes and temperature operating ranges. The complete line covers bore sizes from 3/16 to 6 in. diam.

54 PROPELLER FANS

Hartzell Propeller Fan Co.—A 44-page, 2-color catalog illustrates and describes the company's line of fans. Dimensional and performance tables are included, along with photos and diagrams showing installation requirements of various models.

55 ROLLER CHAINS

Diamond Chain Co., Inc.—Catalog 754 contains information on stock roller chains and sprockets. Selection of stock drives, calculation of chain lengths, installation recommendations, and speed ratio tables are some of the subjects covered in the 64-page catalog.

56 LATTICE BRAID PACKING

Garlock Packing Co.—A completely new folder describes the firm's patented lattice braid rod and shaft packings, and points out the construction features of lattice braid, describes available materials, sizes, and forms. It contains illustrative service reports from users in various industries.

57 DUST COLLECTORS

Prat-Daniel Corp.—An 8-page catalog has been published illustrating and describing the company's Design 4P collectors. Contents include a discussion of the problems of fly-ash collection and the Design 4P tubular collector. Efficiency curves, arrangements, and standard dimensions are given, flue-gas density tables are included with a formula and nomograph for calculating the number of tubes required for any volume and resistance.

58 VERTICAL PUMPS

Food Machinery & Chemical Corp., Peerless Pump Div.—Bulletin No. B-1700 describes and illustrates with technical descriptions the design and construction of two types of "can type" pumps for application to petroleum refinery techniques, line booster service, condensate service and chemical processing service. A process type and a transfer type are available with a capacity range of up to 3000 gpm and head range of up to 1000 ft and a temperature range of up to 400 F.

59 PIPING

A. M. Byers Co.—32-page technical bulletin "Piping for Permanence" presents factual information on requisites of a piping system, definitions and factors affecting service life of piping, information on analysis of water problems and summary of service records in numerous piping services. Illustrated.

New Catalogs GUIDE

60 SCREW CONVEYER

Link-Belt Co.—The 92-page Book No. 2289 contains detailed engineering data on screw conveyers and screw feeders, with selection tables and horsepower formulas, layouts and arrangements, dimensional data, and installation photographs. One table lists 250 materials and classifies them by size, flowability, abrasiveness, average weight.

61 O-RINGS

Linear Inc.—Compact 6-page folder contains tables of standard O-ring sizes as well as dimensional data, for installation. Notes contain general recommendations on clearances, design, material, machining, and finishes for most O-ring applications. A special compound bulletin describing the latest polymers and synthetic rubbers from which O-rings can be moulded is also included.

62 MOTOR SPEED CONTROLS

General Radio Co.—Bulletin describes nine models of motor speed controls with ratings from 1/15 hp to 1½ hp. All models use selenium rectifiers in a circuit arrangement which gives smooth control over a wide speed range. Complete specifications included with application details.

63 REPORTS ON MATERIALS HANDLING

Hyster Co.—Actual case studies from the field are now available. Called "Field Reports," studies cover instructive materials handling operations in many industries. Profusely illustrated with action photographs and written in a concise and factual manner. Indicates industry classification of interest.

64 LAMINATED PLASTICS

Formica Co.—An illustrated 16-page bulletin describes the various applications and types of Formica laminated plastic. The booklet contains tables showing the characteristics of the various grades of the material for various uses. Sections are devoted to tubes and rods, the company's fabricating facilities, printed circuits, insulators and postformed parts.

65 POWER TRANSMISSION EQUIPMENT

Lovejoy Flexible Coupling Co.—Illustrated catalogs cover the following: Flexible Couplings, cushions changed without shutdown, no lubrication needed, 1/4 to 2500 hp. Variable-Speed Pulleys, change speed while motor is running, ratios to 3 to 1, fractional to 10 hp. Select-O-Speed Transmissions, ratios to 10 to 1, fractional to 5 hp. Universal Joints, precision-ground alloy steel, 13 sizes, bores 1/4 to 2 in., lengths 2 to 10⅝ in.

66 ABSORPTION REFRIGERATING MACHINES

Carrier Corp.—6-page brochure describes new type of refrigerating machine for large scale water cooling used in air conditioning and various industrial refrigeration processes. Important features: (1) use of steam to chill water, (2) lack of moving parts, (3) lightest machine available per ton of refrigeration capacity, (4) use of water as refrigerant, (5) ability to automatically adjust from full to 10 per cent of maximum load, (6) ease of operation.

67 HIGH PRESSURE COMPRESSORS

Norwalk Co.—Catalog No. 44 covers high pressure air and gas compressors of all types. Compressors for pressures up to 25,000 psi as well as new three and four stage vertical air and gas compressors are described.

68 O-RINGS

National Motor Bearing Co.—This National O-Ring Catalog is designed for broadest usefulness in all types of O-ring applications. Includes practical working information about O-ring applications, sizes, groove dimensions, back-up rings, and dust seals, and lists all National O-Rings and local National Motor Bearing offices.

69 INSTRUMENTS AND RECORDERS

Brush Electronics Co.—Brush oscillographs, amplifiers, acoustical instruments, and recording analyzers provide usable, permanent records on electrical, mechanical, or acoustical investigations on items such as surface finish, textile fiber uniformity, d-c or a-c voltages or currents, strains, displacements, light intensities, temperatures, and other static or dynamic conditions.

CONTROL IS VITAL
in Steam Traps too!

SUPER-SILVERTOPS LAST LONGER

The Patented Guided Bucket Is Controlled by a Hexagonal Tube

Uncontrolled action inside a steam trap causes trouble. In Super-Silvertops every moving part is "guided" in a true engineering manner. The Super-Silvertop bucket, unlike other traps, is carefully directed on a hexagonal tube. This patented arrangement gives Super-Silvertop users proper venting of condensate and air for a longer period of time. All parts are always in perfect alignment . . . the bucket can't hit the side walls . . . valve must close positively and firmly against the seat. That's why Super-Silvertop cuts the cost of steam trapping . . . and reduces trap maintenance.

Insist upon Super-Silvertops, stocked by leading jobbers everywhere.

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The Controlled Steam Trap

Quality Steam Traps Since 1886

SOLVING STEAM TRAP PROBLEMS

Choice of the right steam trap increases efficiency of equipment as much as 35%. This 36-page manual answers problems on sizing, installation and maintenance. Mail coupon for your complimentary copy today.

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Gentlemen: Please send without obligation a copy of "Solving Steam Trap Problems."

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Company_____

Address_____

City_____ Zone____ State_____

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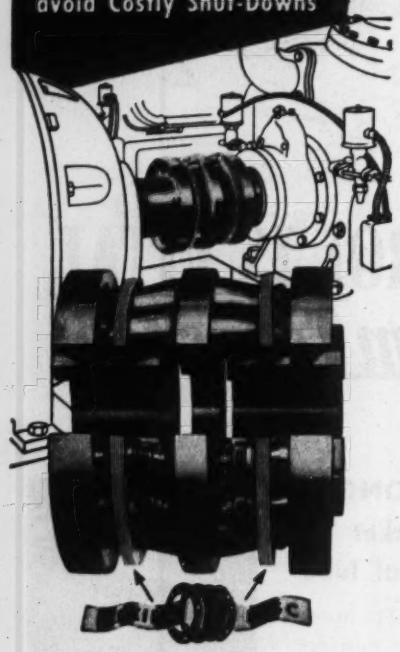
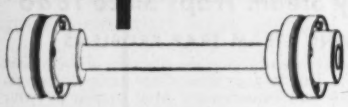
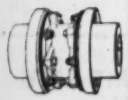
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.





Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

New Catalogs

70 PIPE FITTINGS

Ladish Co.—New 304-page, tabindexed catalog details specification on complete line of controlled quality butt welding fittings, forged ASA, large diameter and TEMA flanges and forged screwed and socket welding fittings. 56-page technical data section features latest provisions of applicable piping codes and standards to assist in solving piping problems.

71 PHOTOCOPYING EQUIPMENT

Peerless Photo Products, Inc.—A 6-page brochure illustrates new Dri-Stat transfer-process photocopying equipment and materials. Describes combination rotary printer and processer, new flat-bed printer, and two models of separate processing unit. Other bulletins describe "Magic Hand" vacuum blanket printer and Neoflow reducing camera.

72 CONTINUOUS FLOW HEATING CONTROL

Warren Webster & Co.—An 8-page illustrated bulletin describes a continuous flow hot water heating control for continuous heating and maximum comfort. Control combines an outdoor thermostat with convenient central manual control. Bulletin describes applications as a single master control and as a master control with three zones, each with indoor thermostats.

73 ELECTRICAL RELAYS

Leach Relay Co.—A 44-page, 2-color, loose-leaf catalog illustrates and describes standard relays which are carried in stock, and also suggests modifications which can be made to accommodate special requirements. Details include characteristics, schematics and dimensions. Catalog is in 5 sections listing midgets, relays, circuit controls, special purpose radio and high frequency, aircraft relays and contactors.

74 ELECTRIC MOTORS

Westinghouse Electric Corp.—A 20-page, 4-color bulletin illustrates and describes the company's new Life-Line motor which features fortified insulation, unitized stator, pre-lubricated bearing assembly, armorized frame and drip-proof ventilation. Also included is information on the company's gear-motors with the new motor mounted directly on the gear case so no coupling is needed.

75 HEAT-TRANSFER EQUIPMENT

Trane Co.—"Extended Surface Heat Transfer Equipment," Bulletin DS-378, is available. The Bulletin describes both Trane Brazed Aluminum and Trane Fin-and-Tube heat-transfer surfaces and exchangers. It gives typical applications, performance data, working temperatures and pressures, and other engineering information.

76 BRONZE, IRON BODY VALVES

Fairbanks Co.—Catalog No. 51 provides complete descriptions and specifications on bronze and iron body valves. Bronze valves of all types with pressure ratings from 125 thru 300 lb steam working pressure are covered, along with bronze solder end and "Fairco-Braze" threadless valves. Iron body valves of all types including clip-gates with pressure ratings from 125 thru 250 lb steam working pressure are listed.

77 PRESSURE GAGES

American Chain & Cable Co., Helicoid Gage Div.—The 24-page Helicoid gage catalog describes the Helicoid gage as guaranteed accurate to within 1/2 of 1 per cent of the total dial graduation over the upper 95 per cent of the 270-deg dial arc. Cutaway photographs and line drawings show the complete line of Helicoid gages.

Your best cancer insurance...

"LIFETIME" POLICY... See your doctor *every year* for a thorough check-up, no matter how well you feel.

"DAY-TO-DAY" POLICY ...See your doctor *immediately* at the first sign of any one of the seven danger signals that *may* mean cancer (1) Any sore that does not heal (2) A lump or thickening in the breast or elsewhere (3) Unusual bleeding or discharge (4) Any change in a wart or mole (5) Persistent indigestion or difficulty in swallowing (6) Persistent hoarseness or cough (7) Any change in normal bowel habits.

Many cancers can be cured, but only if properly treated *before* they have begun to spread or "colonize" in other parts of the body.

For *any* information about cancer just call the American Cancer Society or write to "Cancer" in care of your local Post Office.

American Cancer Society

YOUR New Catalogs GUIDE

78 OIL AND GAS BURNERS

Ray Oil Burner Co.—An illustrated 16-page catalog gives specifications and capacities of commercial and industrial oil and combination gas-oil burners. It covers fully automatic, semi-automatic, and manually controlled horizontal rotary oil burners, gas burners, and combination gas-oil burners; commercial and domestic pressure-atomizing types for oil, gas, or combination gas-oil. Tables and other technical data are included to aid in selection.

79 GRATING, FLOORING, STAIR TREADS

Blaw-Knox Co.—Bulletin 2365 features the Electroforging—® process of manufacturing Blaw-Knox grating and stair treads. Illustrations, charts, and descriptive data point up the strength and permanence of Electroforged, one-piece construction of grating for industry. Two pages of this 16-page bulletin include an accurate table of safe loads, sizes, and specifications for Blaw-Knox grating and stair treads.

80 DRAFTING ROOM EQUIPMENT

Hamilton Mfg. Co.—Catalog No. 14, published in 1954, lists steel and wood drawing tables and files for every drafting room need. It includes comprehensive data on the Auto-Shift drafting table, and information about the shallow-drawer unit with tracing lifter.

81 INDUSTRIAL TELEVISION

Radio Corp. of America—8-page, 2-color booklet outlines planning, installation, service of industrial television for remote observation in plants and describes cameras, control monitors, panel mounting, weatherproof and explosionproof housing, camera switching, pan and tilt unit, water cooled lens, split screen viewing, auxiliar viewers.

82 STROBOSCOPIC TACHOMETERS

Boulin Instrument Co.—A 4-page bulletin describes the company's Visutac stroboscopic tachometer for ascertaining speeds of equipment in the aircraft, oil, textile, automotive, chemical and air conditioning industries.

83 VARIABLE SPEED MOTORS

U.S. Electrical Motors, Inc.—Bulletin No. 1797, 16 pages, contains eighty colored illustrations of the company's motors, mechanical features and remote controls, and outlines information on the use of variable speed motors to improve production.

84 LUBRICATED PLUG VALVES

Homestead Valve Mfg. Co.—A 24-page reference book shows the company's lubricated plug valves in full-port and Venturi types, sizes up to 14 in., and with a choice of self-sealed two-piece or one-piece plug designs. Engineering information includes principal dimensions, types of control, metals, lubricants.

85 BOILERS

Cleaver-Brooks Co.—The company's boiler for steam or hot water, 50 through 80 hp, 15 to 150 lb steam, 30 lb hot water, for commercial, industrial and institutional use is described in bulletin AD 135. A smaller unit for steam or hot water, 15 to 40 hp, is described in bulletin AD 134. Design features, specifications, dimensional data are included in both bulletins.

86 VALVE-IN-HEAD COMPRESSOR

Pennsylvania Pump & Compressor Co.—Bulletin 600 lists advantages found in the company's H-Type cylinder construction valve-in-head compressor. It is said to provide improved cooling, ease of maintenance, and speedy replacement of cylinder liners, if necessary.

87 PIPE HANGERS

Bergen Pipesupport Corp.—Catalog No. 531 describes constant and variable pipe supports and standard hanger assemblies. In numerous sizes, wide range of loads and travels. Operation, sizes, installation, visible reading, maintenance, hydrostatic test stops and safety factor data. Tables on loads, rod diam. dimensions, housing, rod take-out, etc. Many diagrams and line drawings of various installations.

88 A-C MOTORS

Reliance Electric & Engrg. Co.—Bulletin B-2102 is designed to help in selection of both the new and current line of a-c squirrel-cage induction motors for applications from 1 to 200 hp. The selector

Kennametal putty gun tip handling abrasive material under heavy air pressure outlasts hardest steel 14 to 1. Write for Performance Report No. 469.

to designers and inventors who need metals harder than steel

Is the development of *your design idea* hampered by the need for metals harder than steel . . . metals to resist deformation under high pressures, to maintain tolerances under abrasion?

If so, consider Kennametal,* a series of hard carbide alloys of tungsten, titanium, tantalum and columbium with cobalt. Kennametal has a Young's Modulus of Elasticity of 60 million to 90 million psi. This exceptional resistance to deformation will enable you to design parts which will deflect only ⅓ as much as those made of steel.

Hard Kennametal alloys often withstand abrasion 10 to 100 times longer than steel for the same loss of tolerance.

Rigidity and high temperature strength are other favorable characteristics of Kennametal. And, where corrosion or oxidation resistance is a factor, our titanium carbide, Kentanium,* may serve your purpose.

The success of your project or invention may be made possible by the application of Kennametal to critical points.

For more information, write KENNAMETAL, INC., Dept. SA, Latrobe, Pennsylvania, for Bulletin C-53 or tell us about your problem.

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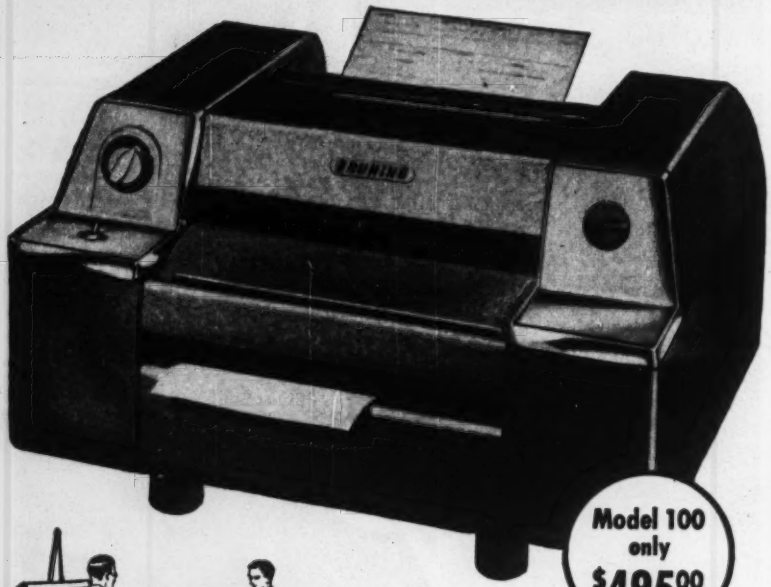

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YOUR *New Catalogs* GUIDE

catalog points out advantages that motors offer in pre-lubricated bearing design, heavier bearing-to-bearing shafts, indestructible pressure-cast rotors, and shock resistant frames. Construction features, selection data, dimensions, prices, and ordering instructions are presented.

89 FLUID FLOW INSTRUMENTATION

Aero Research Instrument Co.—Illustrated bulletin announces the manufacture of new and improved probes for sensing gas temperature, pressure, direction, velocity, and turbulence in and about turbo jets, ram jets, and some rocket engines. These probes are claimed to be generally less expensive units with superior performance characteristics. A research lab has been set up for special problems and facilities are available for custom-built probes for specific designs.

90 CENTRIFUGAL PUMPS

Goulds Pumps, Inc.—Bulletin contains illustrations, composite curves, specifications, dimensions and mechanical data describing new horizontally split case multi-stage double suction centrifugal pumps. They are available in five sizes with capacities to 1200 gpm, heads to 1000 ft. Maximum standardization and interchangeability of parts. Flexible stuffing box permits using conventional packed box or mechanical seal.

91 STEAM TURBINES

Terry Steam Turbine Co.—Bulletins in looseleaf form which cover a complete description of Terry solid wheel turbines with cross section drawings of typical units for both moderate and high steam pressure conditions: a description of the Terry axial flow impulse, both single stage and multi-stage; Terry gears which are used for speed increasing and speed reducing.

92 STORAGE WATER HEATERS

American District Steam Co.—Bulletin No. 54-75A describes storage water heaters for source of hot water needed at irregular intervals. It contains complete text on design, operation, and materials, including clad metals, tables of dimensions, capacities, and necessary connections, and a page of diagrams outlining various operating conditions.

93 TESTING EQUIPMENT

W. C. Dillon & Co.—New Bulletin 19F lists complete Dillon line of universal testing machines, traction dynamometers, mechanical pressure gages, stainless steel bi-metallic thermometers, automatic dial-type scales for cranes and hoists, automatic overload prevention devices for hoists and cranes. Bulletin is illustrated with 37 pictures, and each instrument is described and specifications given.

94 INDUSTRIAL RUBBER PRODUCTS

Raybestos-Manhattan, Inc., Manhattan Rubber Div.—Complete new catalog of all types of industrial rubber products is illustrated with product photos, diagrams and cut-away views, installation pictures. Hose and conveyor belt sections have been expanded to make specification easier. Featured is new Poly-V drive said to eliminate V-belt matching problems and increase drive capacity.

95 MINIATURE BALL BEARINGS

Miniature Precision Bearings, Inc.—A 20-page, 3-color catalog, illustrated with comprehensive specifications on more than 200 types and sizes of standard miniature ball bearings from 1½ mm to ⅜ in. OD, includes material of particular interest to designers of precision mechanisms—applications, lubrication, design variations, special bearings, etc.

96 ADJUSTABLE PIPE HANGERS

Blaw-Knox Co., Power Piping and Sprinkler Div.—New 100-page Catalog 54 features the Blaw-Knox functional spring hangers, vibration eliminators, and overhead roller assemblies. The improving and simplication of complicated piping systems is explained by charts and drawings. A Technical Section enables a piping engineer to solve most hanger load problems and thus determine the hanger requirements for the particular piping under consideration.

97 FLEXIBLE COUPLINGS

Falk Corp.—Bulletin 4100—1953 consolidates information about all types of Steelflex couplings by Falk. A foldout bound into the middle of the book explains the Steelflex design, and the rest of the book is devoted to technical data for use in selecting the proper coupling for different applications, whether it is the standard Type F or a special or dual-purpose coupling.

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

98 MECHANICAL DRIVE TURBINES

General Electric Co.—Type DP mechanical-drive turbines rated from 10 to 1200 hp and 1000 to 6500 rpm are described in a revised bulletin, GEA-4955B. Special design features as well as applications for pumps, compressors, fans, blowers, and similar equipment are covered in cutaways, schematic drawings, and photos.

99 INDUSTRIAL PRODUCTS

American Brake Shoe Co.—First complete catalog, 48 pages, 2 colors, illustrates representative parts produced by eleven divisions of the company and details physical properties or characteristics. The catalog contains sections on ferrous castings, non-ferrous castings, bearing materials, sintered metals, steel forgings, welding products, air compressors, industrial pumps, dredge pumps, and railroad products.

100 RUBBERIZED ABRASIVES

Cratex Mfg. Co.—Adaptability and application of rubberized abrasives, together with complete specifications is contained in new illustrated Catalog No. 53. Cratex rubberized abrasives are especially designed and manufactured for burring, smoothing and polishing operations after dimensional grinding and shaping. They are available in wheels, points, blocks, sticks and cones for machine or hand operations. Four standard grit types range from relatively coarse to extremely fine textures. Applications to hard or soft metals and other materials.

101 BALL BEARINGS

Marlin-Rockwell Corp.—Form No. 1542 contains list of power transmission ball bearings for line shafting, pillow blocks, hanger boxes, flange units, pump shafts and other applications to simplify machine operations.

102 CONTROL INSTRUMENTS

Trimount Instrument Co.—Revised catalog lists the company's new or improved manometers, gages and control instruments. Illustrated are new well type manometers, sliding scale, U tube manometers and draft gages.

103 PEN CLEANER

Higgins Ink Co.—A leaflet describes the sizes in which Higgins pen cleaner may be obtained and the technique of employing it to keep drafting instruments in good condition. Especially interesting to those using lettering instruments designed with a small capillary tube difficult to clean.

Read carefully . . . select wisely, then send coupon on page 44 now for your free catalogs. Requests limited to 25 catalogs. (Sorry, no catalog distribution can be made by us to students.)

104 BOILERS

Babcock & Wilcox Co.—Bulletin G-76-B describes the company's integral-furnace boiler, Type FM. A completely shop-assembled unit, it is available in standard sizes for loads ranging from 2900 to 28,000 lb of steam per hr, at pressures to 235 psi. Illustrations show details of design and construction and typical installations.

105 PUSH-PULL CONTROLS

Southwest Products Co.—Engineering manual No. 1551, 12 pages, describes the company's flexible push-pull controls, compression and tension types. The manual gives detailed prints of three size ranges and includes specifications on materials, finishes and capacities.

106 WELDING

Lincoln Electric Co.—"Elements of Weldesign" is a series of pamphlets issued periodically to design engineers, production men, and management executives. Current series outlines fundamentals of how to design with steel, how to reduce costs, and steel design fundamentals with special charts and checking information.

107 RUST PREVENTIVES

Rust-Oleum Corp.—Catalog 253, a new 16-page general catalog, lists industrial rust-preventive applications. Instructions for surface preparation and application of Rust-Oleum products and 73 color chips of Rust-Oleum products are contained in the catalog.

108 REVOLVING UNIT HEATERS

L. J. Wing Mfg. Co.—Bulletin HR-6 describes revolving unit heaters which feature a revolving air-distributor with one or more outlets. Models are available for steam, hot water, and electric and gas heat supply in a full range of sizes. Also can be used for summer cooling. Design and construction details are included.

109 LIQUID LEVEL CONTROLS

Electronics Corp. of America, Photoswitch Div.—Bulletin PF 544 describes a completely new line of electronic level controls for liquids having a resistivity range of from zero to 20 megohms per cm cube. The system employs no floats, stuffing boxes or moving parts. Corrosion-resistant, stainless-steel probe rods extend to the level of liquid to be controlled.

110 DRAFTING MACHINES, INSTRUMENTS

V. & E. Mfg. Co.—16-page booklet describes and illustrates Vemco drafting machine, plus vertical and detail models and various scales. 20-page booklet covers company's line of drawing instruments and materials.

111 INDUSTRIAL METER SELECTION

Rockwell Mfg. Co.—A new bulletin, No. OG-400, intended to guide the proper selection of meters for measuring more than 200 chemicals, petroleum products, and other liquids with varying corrosive characteristics, is available. In addition to the complete table of metered liquids matched with case, chamber, and piston specifications, the bulletin also includes a simplified specification sheet which makes it easy for the customer to cover all necessary operating requirements so that proper meter recommendations can be made at the factor.

112 SILENT CHAIN

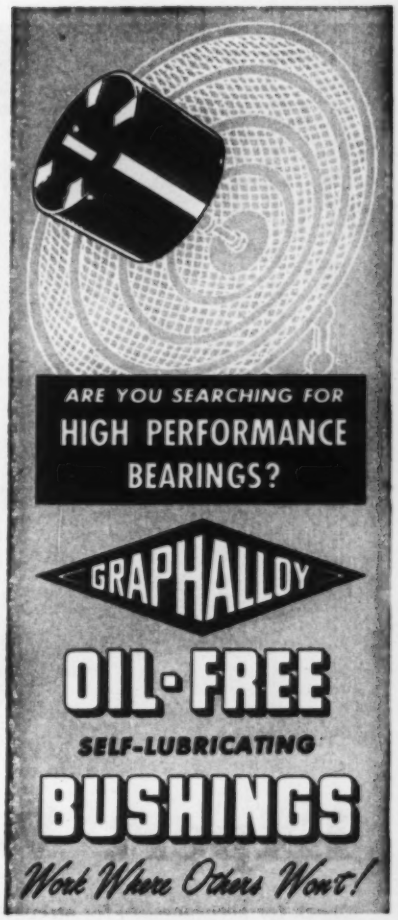
Link-Belt Co.—Book No. 2425 gives service factors, rating tables and selection methods for applying stock or special components of the company's silent chain to various drive requirements ranging from fractional hp drives in hand tools to large industrial applications.

113 CYLINDRICAL ROLLER BEARINGS

General Motors Corp., Hyatt Bearings Div.—Complete catalog on cylindrical roller bearings giving dimensions, load ratings and application data on six major types of Hyatt roller bearings. Sixty-eight pages, Catalog 150.

114 WATER CONDITIONING DATA BOOK

Permutit Co.—Pocket size Data Book No. 2478A, 108 pages, is a compilation of data on such subjects as hydraulics, impurities in water, chemicals used in water treatment, ion exchange resins, specific gravities of fluids and chemical reactions. Included are 78 tables of information.



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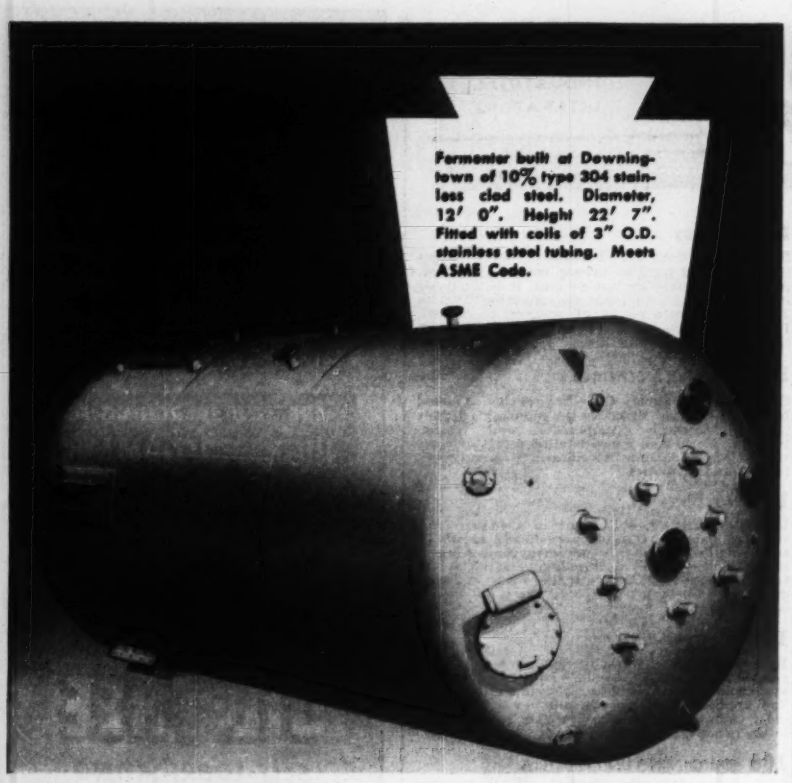
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New Catalogs GUIDE

115 CENTRIFUGAL PUMP

Pacific Pumps, Inc.—Bulletin 121 describes the company's new type SVS single-stage, single-suction centrifugal pump for process service in refineries, natural gasoline plants and petrochemical installations. The bulletin illustrates the design features of the pump, specifically designed for the most advantageous application of the mechanical shaft seal, but also available with conventional packing.

116 FIXED TYPE GAGES

Sheffield Corp.—Catalog FG 54-55, 150 pages, is composed of six sections covering the company's standard fixed type gages. A complete engineering manual for gage designers and users is included in the catalog.

117 PULVERIZING EQUIPMENT WITH CEMENTED CARBIDE

General Electric Co., Carboloy Dept.—Bulletin WR-107 discusses the improvement of pulverizing equipment with cemented carbide. Shows how it operates more efficiently in grinding faster, better and at lower cost. Tabulates materials which can be ground. Increases wear and hammer life. Shows carbides for heavy duty applications.

118 SUPER REFRACTORIES

Carborundum Co., Refractories Div.—Form No. 5120 describes super refractories in well illustrated text and tables with engineering data on use and selection. Subjects cover Carborundum, Carbofrax, Alfrax, Mulfrax, and Monofrax. Corrosion or abrasion, heat conductivity and chemical inertness are discussed.

119 ELECTRONIC COMPUTER

Underwood Corp., Electronic Computer Div.—Brochure describes the company's Elecom 120 series designed for computations of sales trends, market analyses, payrolls and other commercial applications as well as for scientific research and engineering computations. Specifications and operating data are included. Also offered is a technical paper on the company's Elecom 125 electronic business system and a series of technical data sheets on the 120 series.

120 STAINLESS STEEL FABRICATION

U.S. Steel Subsidiaries.—136-page handbook describes stainless steels produced by U.S. Steel lists all properties, and provides complete details on end use and fabricating practices. Includes data on welding, riveting, soldering, joint design, machining, cutting, forming, annealing, pickling, and surface finishing and protection.

121 LOCKNUTS AND LOCKWASHERS

Standard Locknut & Lockwasher, Inc.—Bulletin No. 32 describes Standard's line of lock nuts and lock washers for ball- and roller-bearing applications, designed to SAE and ABEC applications. Dimensions of locknuts, lockwashers, and shafts are included.

122 MOTOR, PHASE ROTATION TESTER

James G. Biddle Co.—4-page bulletin No. 80 illustrates, describes and gives operating information on motor and phase rotation tester for determining the direction of rotation of electric motors before they are connected to the line and determining the phase rotation or sequence of energized power circuits.

123 PACKAGED BOILERS

Superior Combustion Industries—Illustrated, 22-page catalog provides complete data on factory assembled and factory tested Superior steam generators of the fire-tube type. Large fold-out cover shows cut-away illustration detailing features described in text. Catalog gives complete specifications, data, and dimensions of 18 sizes ranging from 20 to 600 bhp for pressures to 250 psi and for hot water. Details of equipment supplied for firing both gas and oil are provided together with a comparison of controls.

For Consulting Engineers
Turn to Page 148

124 PLASTIC GEARS

Westinghouse Electric Corp.—Micarta phenolic laminate gear material for silent gear operation, claiming tooth deflection 30 times that of steel, is covered in 16-page book No. B4661 complete with design tables and formulas along with application and machining information.

125 SPREADER STOKERS

Hoffman Combustion Engineering Co.—Catalog No. 51-CAD describes and illustrates features of moving-grate spreader stokers. Catalog 51-PDG describes, illustrates, and supplies additional information on spreader stokers with dumping grates. Capacities from 20,000 to 250,000 lb of steam per hr.

126 INDUSTRIAL INSTRUMENTS

Leeds & Northrup Co.—20-page catalog ND42 describes manually operated indicators for measurement of temperature, electrolytic conductivity and pH. Both panel-mounted and portable instruments are listed and described, together with complete information on circuitry ranges.

127 FIRE EXTINGUISHING

Grinnell Co.—More effective control of fire, with less water, for a wide variety of hazards is described on "Grinnell Automatic ProtectoSpray," which explains a new coordinated three-way attack upon fire. It has special value for fire hazards involving high-piled storage, rubber, flammable liquids, paints, and flash-fire materials.

128 VALVES

Golden Anderson Valve Specialty Co.—A combination of several bulletins describing the various types of valves. Deals with water, steam, float control water pressure reducing, altitude control surge relief, solenoid, swing check, hydraulic coke quenching, non return, automatic engine stop, hydraulic check, steam pressure and unloading valves. Fully illustrated with diagram and tables.

129 AUTOMATIC CONTROLS

Mercoid Corp.—Catalog Number 700B, a 64-page reference book for engineers, contains information on automatic controls for pressure, temperature, liquid level, and mechanical movement. Transformer-relays and mercury switches are also listed.

130 VENTILATION FILTERS

Dollinger Corp.—Model WKE Dry Panel Filters for ventilators and air conditioners are described in Bulletin 600, 8 pages. The Model WKE is available in several sizes, and a table gives capacities and other specifications for each size. Curves showing performance characteristics are given. Information for selection and installation is included.

131 GAGES AND INDICATORS

Ernst Water Column & Gage Co.—Bulletin 1-6-54 has been released, covering some of Ernst specialties, such as bronze, iron, and stainless steel liquid-level gages; also trycocks, illuminators, and flow indicators.

132 WORM GEARS

Vard, Inc.—Engineering data catalog No. 1002 covers hardened and ground double enveloping worm and gear wets. Sketches, performance graphs, and photos are used to illustrate the units. The catalog also contains a sample design problem worked out step by step.

133 STEAM TRAP

Coe Mfg. Co.—12-page catalog No. 903-D describes the Drainator, the company's continuous flow steam trap said to operate on a new principle which eliminates intermittent action and numerous wearing parts. Design and engineering data is included in diagrams, tables and cut-away photographs. Installation and adjustment facts are also listed.

134 STEEL VALVES

Edward Valves, Inc.—New 28-page condensed catalog 105 contains information on complete line of forged and cast steel valves for boiler rooms, petroleum service, industrial and technological plants, including details of design, material specifications, pressure and temperature ratings and dimensional details and weights. In addition, this new catalog contains information on the new Edward line of abrasive fluid valves.

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135 HEAT EXCHANGER

Niagara Blower Co.—Bulletin 124 describes new high capacity model Aero heat exchanger. Application is for water, oil, air or gas cooling, independent of a cold water supply, saving 95 per cent of cooling water cost. Temperature is held uniform by balanced wet-bulb temperature control, capacity is 30 million Btu. Bulletin includes installation photos and diagrams.

136 INDUSTRIAL VACUUM CLEANING

Spencer Turbine Co.—Bulletin 125-D illustrates the company's machines in use for conveying, collecting, reclaiming, sanitation and other uses. Machines run from 1/3 to 75 hp on portables and up to 100 hp on stationary models. Accessory equipment is also listed.

137 SHAFT SEALS

Syntron Co.—Folder describes fully mechanical shaft seals designed to eliminate leakage of gases and liquids around rotating shafts of compressors, pumps, turbines, engines, machines, propeller shafts, mixers, etc. Also covers fluid couplings for rotating, hollow shafts.

138 PRECISION TOOLS

Lufkin Rule Co.—Catalog No. 7 has data on micrometers, micrometer calipers, heads, thread comparators, depth gages, combination squares, bevel protractors, rule clamps, squares, universal indicators, calipers, blocks and clamps, pin vises, punches, steel rules. Full data, illustrations, prices. Also data on magnetic tools.

139 AUTOMATIC LUBRICATION

Bijur Lubricating Corp.—Bulletin describes three basic elements involved in automatic lubricating systems. Central lubricators for rotary, oscillating, hydraulic, electrical or hand operation are described, as well as the meter-units for each bearing, and other distribution system parts.

140 SCREW PUMPS

Warren Steam Pump Co.—Twelve-page, two-color Bulletin S205 is devoted to Standard Gear-in-Head, High-Pressure Long-Body Gear-in-Head, and standard Vertical Gear-in-Head types of Warren-Quimby Screw Pumps. Basic construction and design are discussed in detail and there are sectional views with indicated features; also external and installation illustrations, dimensions, and specifications. Bulletin S206 includes comparable information as applied to Double External Bearing and Hopper types of Warren-Quimby Screw Pumps.

141 DROP FORGINGS

Drop Forging Association—"Metal Quality—Hot Working Improves the Properties of Metal," a 64-page booklet recently revised and issued by the Technical Committee, Drop Forging Association, for design engineers, metallurgists, and production-management executives, explains how hot-working improves metal quality. The text describes forging-quality steel and details of the various methods of forging. Check lists of the advantages obtained by use of forgings, economic benefits, are included.

142 FRACTIONAL-HORSEPOWER GEARS

Gear Specialties, Inc.—A 6-page bulletin illustrates and describes complete facilities together with different types and applications of G.S. small gears from 12 to 96 diametral pitch. Several diametral pitch and circular pitch charts included.

143 GAS COMPRESSOR VALVES

J. H. H. Voss, Inc.—Bulletin 53-G covers Voss Valves for the replacement of worn or inefficient valves in air, gas, and ammonia compressors. The valves are machined from solid stock and plates are machined and ground; valves and plates are of heat-treated alloy and stainless steel, and are designed to specification to fit the individual compressor for which they are manufactured.

144 PULVERIZER

Kennedy Van Saun Mfg. & Eng. Corp.—Bulletin 44-C describes the Kennedy air-swept ball tube pulverizer, which does fine grinding of all materials including coal at capacities up to 50 tons per hour, availability nearly 100 per cent. Moisture is evaporated in the mill during pulverization. No magnetic separator is employed and low maintenance is guaranteed, according to the manufacturer.

145 AIR, GAS COMPRESSORS

Bury Compressor Co.—Type BPPE motor driven air and gas compressors are described in a catalog which includes cross section multi-colored views to show internal construction of compressors and the company's valves. Also shown is the Bury intercooler unit which provides double pass cooling between stages.

146 TEFLON GASKETS AND PACKINGS

Crane Packing Co.—Bulletin covers "Chemlon" trade name for gaskets and packings fabricated from Teflon. Describes properties, uses as packings, gaskets, celectromic insulation, non-stick uses. Also covers C-V rings, braided packings, molded packings, extruded Teflon rod and tubing, molded forms and tape and products for general industrial application.

147 OFFICE COPY MACHINE

General Aniline & Film Corp., Ozalid Div.—A 4-page illustrated pamphlet features the new Ozalid Bambino, a fast, inexpensive, and compact copy machine for use on correspondence, accounting reports, purchase orders, invoices, and other administrative paper work. Pictures illustrate the operation of this machine and specifications describe its dimensions and capacities.

148 WRENCH-OPERATED CHUCKS

Cushman Chuck Co.—Catalog 65-1954 contains engineering data and prices on light-, medium-, and heavy-duty, independent, self-centering, and combination chucks recommended for engine, toolroom, manufacturing, and turret and automatic lathes. It is indexed.

149 STEEL TUBING

Republic Steel Corp., Steel and Tubes Div.—An 8-page bulletin lists the various types of mechanical and pressure tubing and stainless tubing, and meth-

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ods used for finishing and fabricating them. In addition to design data giving chemical and mechanical properties, the pamphlet contains many illustrations of typical applications.

150 WATER CONDITIONING

Elgin-Refinite, Div. Elgin Softener Corp.—Bulletin 611A covers water conditioning under headings of Zeolite softeners, Ultra deionizers, boiler water, process, filters and purifiers, degasitors, chemicals, water conditioning modernization and Zeolites of all types. Bulletin 512 describes Ultra deionizer for producing completely mineral free water at low cost.

151 BITUMASTIC PROTECTIVE COATINGS

Koppers Co.—Informative package of six bulletins covers (1) Bitumastic Hi Heat gray for high-temperature corrosion prevention; (2) Bitumastic Black Solution for general, low-cost maintenance; (3) Bitumastic Super-Service Black heavy-duty coating for more severe conditions; (4) Bitumastic No. 50, extra heavy-duty coating for extremely severe corrosive conditions; (5) Bitumastic No. 28, heavy-duty coating for atmospheric corrosion control; (6) Bitumastic Tank Solution, quick drying, useful for water tanks, etc.

152 COMBUSTION, BOILER CONTROL

Continental Foundry & Machine Co., Copes-Vulcan Div.—Bulletin 1022 is a 12-page presentation of Copes-Vulcan plant facilities and products, including combustion control, boiler feed control, pressure reducing and desuperheating, hi-lo water alarms and soot blowers. Illustrated with photographs and diagrams.

153 TORQUE LIMITER

Morse Chain Co.—Catalog C14-54 describes new Morse slip-type overload protection device. Dimensional data, engineering data and special adaptation drawings are included.

154 FUEL CELL FASTENER

Waldes Kohinoor, Inc.—A 7-page catalog provides engineering data and specifications for the company's Waldes positive lock fastener, which is used to hold airplane fuel cells in place without piercing the cell wall on installation. Illustrations and charts explain the use and method of application for the device.

155 SLEEVE-TYPE BEARINGS

Clevite Corp., Cleveland Graphite Bronze Co. Div.—16-page catalog, "Bearings and Bushings" illustrates range and variety of products manufactured. Bushings, thrust bearings and wear plates, heavy-wall bearings, main and connecting rod bearings, aircraft engine and camshaft bearings are described and pictured, also new line of Cletex oil-impregnated, fibre-lined bushings. Also description of research and development work, and material analyses for 19 bearing alloys.

156 WIRE FORMS

Dudek & Bock Spring Mfg. Co.—Educational brochure gives complete story on the nature and uses of wire forms. Shows how wire forms can do the job of more complicated parts. Brochure translates technical data into understandable language. Also includes valuable informative chart on coil spring manufacturing variations.

157 HIGH STRENGTH, LOW-ALLOY STEEL

Bethlehem Steel Co.—New 66-page catalog, "Mayari R—Bethlehem's High Strength Corrosion Resisting Steel," describes properties and features of this steel. Included also are photographs showing use of Mayari R in industrial and construction industry equipment; in bridges, pipe and penstocks, and in mining, transportation, and other industrial fields.

158 PUMP SELECTION

Taber Pump Co.—Bulletin S-146, 8 pages in 2 colors, entitled, "Practical Guide to Pump Selection," discusses pump development, application and performance. It is illustrated with various models of the company's rotary, centrifugal and vertical centrifugal pumps and includes sections on vertical pump bearings and corrosion.

159 SELF-CONTAINED BOILERS

Cleaver-Brooks Co.—Boiler Catalog No. AD-100 includes complete description of the Self-Contained LR Boilers for heating and processing. The catalog lists features, shows typical applications, covers design, construction, and efficiency, and contains

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charts on capacities and dimensions. Back cover contains complete list of sales representatives handling and servicing Cleaver-Brooks Self-Contained Boilers.

160 CONTROL INSTRUMENTS

Minneapolis-Honeywell Regulator Co.—Catalog 5001 concisely lists line of industrial measuring and controlling instruments. Also covered are panelboards, related instruments and instrument systems. Functional descriptions, illustrations and identification of more exhaustive literature available on each.

161 CONVEYOR SYSTEMS

Ajax Flexible Coupling Co.—Bulletin 39, 16 pages, illustrates and describes self-contained vibrating conveyors which can be installed on floor, below floor, or suspended from wall or ceiling. Units feature company's Lo-Veyor and shaler shaker. Drive unit is completely enclosed and runs in oil-tight case. Various models are illustrated and installation and design data are included.

162 ELECTRIC MOTORS

Allis-Chalmers Mfg. Co.—Catalog 51B6052 is designed to help determine the electrical and mechanical characteristics desired in commonly used motors and to indicate availability of less frequently used types and larger motors that may solve more involved application problems.

163 PLASTICS

Union Carbide & Carbon Corp., Bakelite Co. Div.—12-page reference file of plastics and resins contains 80 photographs showing applications and finished products. Data on special and general purpose phenolic, styrene, polyethylene presented in 18 categories under: molding and extrusion; wire and cable covering; bonding resins; protective coating resins; laminating; rigid sheets; film and sheeting; calendering materials. Replete with technical data.

164 BRONZE SLEEVE BEARINGS

Bunting Brass & Bronze Co.—Standard stock industrial cast bronze sleeve bearings, bronze bars, electric-motor cast bronze sleeve bearings, and graphited oilless sleeve bearings are contained in Catalog 52. There are 854 different sizes of standard stock bearings, from $^{5}/_{16}$ in. to $4^{1}/_{2}$ in. ID, and 324 different electric motor bearings, as well as 263 sizes of tubular and solid bars.

165 PACKAGE STEAM GENERATORS

Henry Vogt Machine Co.—New 12-page Bulletin PSG-1 has photos, line drawings, and engineering data for package unit steam generators from 10,000 lb per hr to 30,000 lb per hr capacities.

166 MEASURING EQUIPMENT

General Electric Co.—Recently revised 64-page catalog, GEC-1016, describes all their testing and measuring devices, including radiation instruments. Given briefly are product descriptions, specifications, prices and a reference guide for laboratory or production line needs.

167 ELECTRICAL HEATING UNITS

Edwin L. Wiegand Co.—Booklet illustrating and describing 101 ways to apply electric heat and showing approved methods of electrically heating liquids, air, gases, machine parts and process equipment. All items are illustrated and described in detail and varied applications are shown. The heating units go under the trade name of chromolox.

168 COIL SPRINGS, WIRE FORMS, AND METAL STAMPINGS

Dudek & Bock Spring Mfg. Co.—Bulletin shows how the manufacturer's free design service can save users many dollars. Special instruments developed to take the guesswork out of specifying, inspecting, and testing are described, together with engineering charts and data.

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169 PLANT LAYOUT SYSTEM

Peerless Photo Products, Inc.—An illustrated 4-page bulletin tells how conventional plant layout procedures which entailed high cost and many man-hours of drafting are now replaced with a low-cost plant layout system involving the use of photocopy. Countless prints of the master layout are said to be possible on a Peerless "Magic Hand" vacuum-bed printer without damage to the original or loss of sharp reproduction. A complete file of successive plant layout prints is always on hand, with minimum cost and labor.

170 ADJUSTABLE-SPEED DRIVES

Reliance Electric & Engrg. Co.—Bulletin D-2102 describes V-S Jr. drive. Completely packaged and all-electric, this adjustable-speed drive furnishes stepless adjustable speeds from a plant's a-c circuit. These packaged $^{1}/_{4}$ to 3 hp drives consists of an operator's control station, adjustable-speed drive motor, and control unit. Applications, functions, dimensions, characteristics, and auxiliary equipment are also presented.

171 SILICONES

Dow Corning Corp.—"A Reference Guide to Dow Corning Silicone Products" is a new general catalog which lists over 60 different Dow Corning Silicones according to their physical form and applications. Important properties for each product and code numbers of obtaining more information about any particular product are presented in this 8-page bulletin.

172 PORTABLE DIESEL POWER PLANTS

American Locomotive Co.—Bulletin DE-5, "Alco Power Packages," 12-page, 2-color booklet gives outline dimension drawings, isometric cutaway, and installation photographs of new line of diesel-powered skid- or rail-mounted generating and pumping units, ranging from 565 to 1300 kw for the generating units and 800 to 1840 hp for pumping and power-takeoff units. Includes complete engine and generator specifications, weights, parts identification, applications for base load plants, fringe networks, temporary and stand-by service, pipeline pumping, construction, dredging, oil-field drilling, irrigation, and other industries.

173 PIPING DESIGN

Blaw-Knox Co., Power Piping and Sprinkler Div.—The design of piping for flexibility with Flex-Anal Charts is covered in an 86-page book. It fills the need for the flexibility analysis of any piping system. It is intended for the experienced pipe designer who can, by use of this method and the application of Flex-Anal Charts, accurately analyze most piping systems in a few hours which formerly required days and even weeks. Many tables, Flex-Anal Charts, and typical piping layouts are included.

174 RESERVOIRS, STANDPIPES

Chicago Bridge & Iron Co.—A 24-page booklet contains illustrations of installations of Horton steel reservoirs and standpipes from 50,000- to 10,000,000-gallon capacity with cone, umbrella or ellipsoidal roofs and ornamental structures with special architectural features. Also included are a table of standard capacities and detailed information on foundations.

175 ROTARY STEAM JOINT

Seamlex Co., Inc.—Bulletin 5030 illustrates engineering features said to be responsible for leak-proof, efficient performance of the company's rotary steam joints. Pressure equalizing chamber maintains minimum pressure against seal regardless of working pressure; floating seal eliminates destructive impact of misaligned revolving shaft; external screw adjustment permits compensation for wear without removal of rotary joint.

176 HOLLOW TOOL STEEL

Crucible Steel Co. of America—Folder describes hollow tool steel in AIRDI 150, air hardened, carbon high chromium, KETOS, oil hardened, non-deforming SANDERSON, water hardened, special quality. Typical applications listed with weight tables, and tables of sizes to finish. Practical steel tool selector with full use instructions for proper selection of tool steel required is also offered.

177 SPUN END PROCESS

Wolverine Tube, Div. of Calumet & Hecla Inc.—Brochure describes the distinctive Spun End Process. In 28 pages it tells a concise story of a revolu-

tionary metal-forming process that is highly efficient and relatively inexpensive. A quick comprehension of the process is gained through the many photographs, diagrams, and descriptions that make comparisons between old and new methods.

178 DRAFTING AIDS

John R. Cassell Co.—A catalog of stencils and templates for drafting also contains detailed information and drawings on axonometric projection and axonometric drawing in their three typical modes, trimetric, dimetric and isometric.

179 PIPING FABRICATION AND ERECTION

Dravo Corp.—A 24-page illustrated booklet, Bulletin No. 1700, shows piping installations in steel mills, for gas transmission systems, central power stations, water pumping stations, heating plants, oil refineries, and chemical process plants. Dravo's engineering and fabrication facilities are also illustrated and described.

180 CHIMNEYS AND STACKS

Consolidated Chimney Co.—Booklet describes and illustrates the features and installations of Consolidated chimneys, including brick, reinforced concrete and steel stack. It also covers design data, detail diagram of lining, and vent lightning protection specification, and standard specifications for radial-brick and reinforced-concrete chimneys.

181 HOISTS

Shepard Niles Crane & Hoist Corp.—Bulletin 186 describes and illustrates the company's line of single I-beam electric hoists. Hoists of varying capacities, lifts and speeds are shown in actual use. Details of construction, together with a sectional view of the hoist driving mechanism, are included.

182 SPIRAXIAL COMPRESSOR

Roots-Connersville Blower Corp.—Bulletin SC-354 describes the company's new spiraxial compressor designed with greatly increased operating range in both capacities and pressures. The bulletin contains a selection table, performance characteristics and illustrations of the unit.

183 WATER CONDITIONING

American Water Softener Co. Inc.—Application, function, operation and design of various types of the company's water conditioning equipment are described in 6-page Bulletin 200. Simplified drawings are included for spray atomizer and jet tray deaerators, hot process softeners, reactors, de-alkalizers, demineralizers, continuous blowdown and other equipment.

184 TECHNICAL BOOKS

Lefax Publishers—Over 2000 listings of Lefax pocket-size technical books are contained in the newly revised 1954 Lefax list of technical data sheets. Condensed, mathematically accurate source materials for engineers, construction men, technical workers, and technical students. Each book consists of approximately 140 pages of easily read tables and data in pocket-size, loose-leaf form for handy reference right on the job.

185 CONTROL VALVES

Valvair Corp.—Bulletin SK-53 describes solenoid pilot operated control valves with emphasis on valve performance. Engineering features fully described in illustration, diagram and tables. Wide range of models and applications shown in illustration. Full details and specifications are included.

186 TORQUE-TESTING FIXTURE

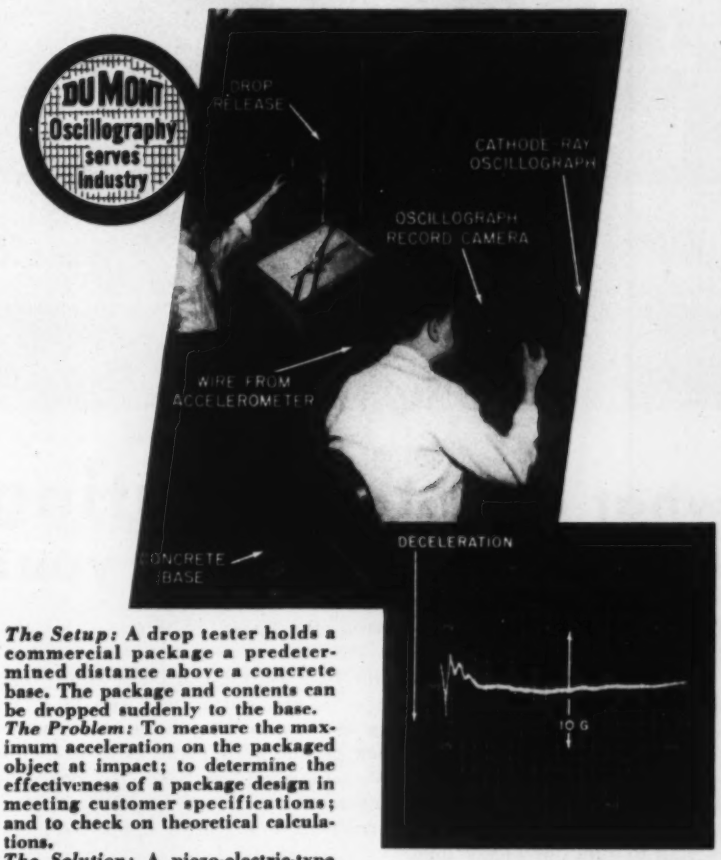
P. A. Sturtevant Co.—A new torque-testing fixture for making ultimate-torsional-strength tests, open-hole torque tests, and driving and stripping tests of various types of screws is described in Bulletin TTF-53. Applications, such as checking strength and thread-cutting ability of taps, and strength of screw-driver bits and socket wrenches, and complete specifications are given. Special-application testing fixtures, SPT Model Push-Off Fixture, SPT Model Sensitive Compression Tester, SPT Model Hair-Spring Torsion Tester, etc., are included.

187 LUBRICANT DATA

Fiske Bros. Refining Co., Lubriplate Div.—1954 edition of The Lubriplate Data Book to all who are interested in subject of proper lubrication of all

Applications of cathode-ray oscillography

DROP TEST



The Setup: **A drop tester holds a commercial package a predetermined distance above a concrete base. The package and contents can be dropped suddenly to the base.**

The Problem: **To measure the maximum acceleration on the packaged object at impact; to determine the effectiveness of a package design in meeting customer specifications; and to check on theoretical calculations.**

The Solution: **A piezo-electric-type barium-titanate accelerometer* is attached to the object in the package and small wires from the accelerometer are brought out the side of the package to the measuring equipment. The output of the accelerometer is applied to the Y-axis input of a cathode-ray oscillograph** through a cathode-follower stage. The cathode-follower stage presents a very high impedance to the high internal impedance of the accelerometer to prevent loading effects which would give inaccurate results. The output of the accelerometer is calibrated directly in millivolts per G so that it is a simple matter to set up the cathode-ray oscillograph to read directly in G's per inch of Y-axis deflection.**

In this application, the specifications called for the package to be dropped on a corner from a height of 3 feet and the contents not to receive a deceleration of greater than 10 G. The sweep of the oscillograph is triggered from the initial rise of voltage produced by the accelerometer upon impact. The sweep time is set with an external time calibrator to write at one millisecond per inch. The Y-axis amplifier of the cathode-ray oscillograph is adjusted to give two inches of deflection for 10 G. It is seen from the waveform that the maximum deceleration experienced by the object within the package was slightly more than 5 G or well within specifications. The waveform was recorded with a standard oscillograph-record camera.* An important application of cathode-ray oscillography at the package design and testing laboratories of Cargo Packers Incorporated, 73 Rutledge Street, Brooklyn, N. Y.**

*** A complete compilation of transducers suitable for oscillography is available from Du Mont at $3.00 per copy.**

**** Du Mont Type 304-A**

***** Du Mont Type 297**

DU MONT
for Oscillography

For further information concerning the Du Mont instruments used in this application, contact:

ALLEN B. DU MONT LABORATORIES, INC.
Technical Sales Department, 760 Bloomfield Avenue, Clifton, New Jersey

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But have you ever thought of how steel grating can make your danger spots safe . . . by covering an unprotected open pit or light well, by guarding a fan, by providing some sturdy shelving, or by serving some purpose you'd never thought of before. Look around your plant, both inside and outside, to see where you can use versatile steel grating . . . to make your plant an even better, safer place to work.

If you come across some tough problem on a grating application, we'll be glad to offer our suggestions.

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A short note will bring you a copy of new Bulletin No. 2365-R —a dimensional sketch will bring you a quotation.

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GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating

types of machinery. This new Data Book is 8-12 × 11 in. in size and contains 36 pages of valuable data pertaining to improvement of machine operation, reduction of power consumption and lowest possible maintenance costs through the use of specialized time tested lubricants.

188 PNEUMATIC CYLINDERS

Westinghouse Air Brake Co.—Bulletin C3-41.01 of Industrial Products Division describes pneumatic cylinders. Advantages of streamlined barrel construction are pointed up as is method of ordering with specifications and dimension tables. Shown with foot, flange and swivel mounting kit. Data for selection of cylinder levers and mounting parts reference.

189 VALVES

DeZurik Shower Co.—Catalog describes the line of plug valves and contains an extensive list of recommendations of materials for specific fluids, solutions, suspensions, etc. Advantages of DeZurik valves, including the cylinder-operated valve-positioner, are explained. Specifications for pipe-line strainers, are included.

190 FLEXIBLE-SHAFT POWER DRIVES

Elliott Mfg. Co.—Catalog No. 221 describes applications of flexible shafts for power drives and heavy-duty power drives. It gives factors which determine specifications and primary requirements in engineering flexible-shaft power drives. It lists information required by Elliott engineering service in offering solutions to power transmission problems without cost or obligation.

191 COUNTERPOISE PIPE HANGER

National Valve & Mfg. Co.—Bulletin 153 describes and illustrates the Navco Counterpoise Pipe Hanger used in steam generating stations, refineries, and chemical plants. Said to be the first accurate and efficient support for high-temperature piping systems, its features permit flexibility of installation, a saving in space, and a minimization of the friction problem. The Navco Counterpoise Pipe Hanger is available in 16 frame sizes with load capacity from 200 to 16,000 lb and expansion travels up to 12 in.

192 PUMPS

Detroit Harvester Co., Pioneer Pump Div.—Bulletin 160-26 describes the complete line of Pioneer and Rollway pumps. Centrifugal pumps, including self-priming auxiliaries and separate tank units are illustrated with line drawings and photographs. Rollway positive displacement pumps for handling lubricating oils and other liquids with lubricating properties are shown.

193 OIL SEALS

Johns-Manville Co.—Bulletin PK-842 describes new Clipper oil seal types LPD and RPD which are concentrically molded synthetic rubber seals designed to exclude dirt and retain lubricant with almost frictionless shaft contact. They are said to seal under wide range or equipment variables and service conditions, including slightly out-of-round cavities.

194 HOT-DIP GALVANIZING

American Hot-Dip Galvanizers Assn.—A 16-page booklet outlines rust prevention in industrial and consumer products through the use of the hot-drip galvanizing process. Included are photographs of products made by the method, and illustrations of production and quality control. A chart compares the method with other types of rust prevention.

195 FLEXIBLE, SWIVEL, SWING, AND REVOLVING JOINTS

Barco Mfg. Co.—A group of catalogs cover flexible, swivel, swing, and revolving joints for piping and lines conveying steam, oil, air, gasoline, water, chemicals, including corrosive acids and alkalies, and other fluids or gases. Types cover pressures up to 750 psi, steam, and 7500 psi hydraulic. Complete range of sizes. Catalogs No. 215 "Flexible Ball Joints"; No. 265 "Rotary Swivel Joints"; No. 400 "Barco Swing Joints"; No. 300 "Revolving Joints" and No. 269 "High Pressure, Hydraulic Swivel Joints."

196 DRAWING PENCILS

A. W. Faber-Castell Pencil Co.—An illustrated booklet describes the advantages of Castell pencils and shows the relative shading of each of the 20 available grades. A chart shows the recommended first, second, and third requirements of different hardnesses of lead for different drawing and sketching activities in construction, industry, architecture, and surveying.

197 AIRCRAFT HEATING

General Metals Corp., Adel Div.—An 8-page catalog illustrates and describes the company's anti-icing, heater and fuel system equipment for aircraft. Each product line is pictured with dimensional diagrams, performance charts and specification tables.

198 IMPACT ALUMINUM EXTRUSIONS

Aluminum Co. of America—Alcoa Impact Fact Book describes the one-piece, seamless, semi-hollow or solid parts having forged bases and one or more extruded side walls. Process is fully explained and design variations and shapes are shown. Tolerances, alloy selection, chemical composition and mechanical properties of wrought aluminum alloys are shown in charts.

199 WORM GEAR SETS

Foote Bros. Gear & Mach. Corp.—Engineering manual SW contains complete data on worm gear sets and catalogs such related items as retainers, bearings, shims and seals. Selection guide, rating tables, capacity information on eleven different sizes are included.

200 AIR, OIL PUMPS

Kraissl Co.—A loose-leaf catalog contains data sheets outlining important features of company's complete line of products. Newest bulletins included describe new line of fan cooled air pumps with integrated oil separator and return system, class 60 series oil pumps which have been listed as standard by Bd. of Fire Underwriters, and class 72 series separator bulletins including Underwriter listed models.

201 DIRECT-FIRED HEATERS

Arthur A. Olson & Co.—Folder describes space heating direct-fired heaters also used for make-up air, drying, oven, process and high temperature applications. Explains operations, advantages, also has tables for selection with diagrams.

202 BALL AND ROLLER BEARINGS

Parkersburg-Aetna Corp., Aetna Ball & Roller Bearing Co. Div.—Latest 52-page catalog gives specifications on Aetna's full line of standard ball thrust bearings, clutch release bearings, ball retainers, and hardened and ground washers. Contains technical data for design engineers, useful calculations and formulas, important application principles, fundamentals of proper lubrication, bearing selection and care.

203 COUPLINGS

John Waldron Corp.—Catalog No. 55 describes in detail gear, Francke, junior couplings and overload cut-out pulleys. Line drawings, tables of bore, hp, dimensions, weight, sizes. Full data, line drawings and illustrations, plus tables on cut-out pulleys.

204 VALVES

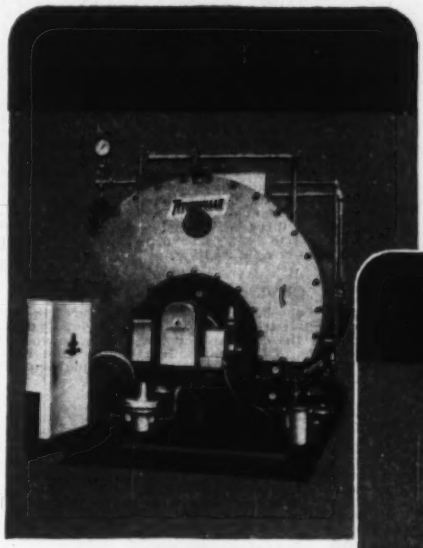
Ohio Injector Co.—An easy-reference illustrated catalog gives engineering and manufacturing data on a line of bronze, iron, and cast and forged steel valves. Special tables and an index are included to facilitate selecting. The booklet also covers valve accessories and parts.

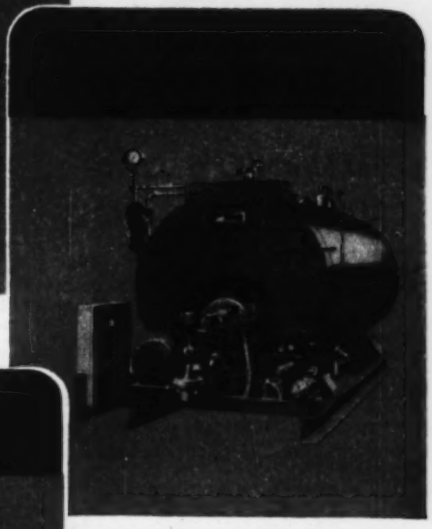
THE UNITED WAY

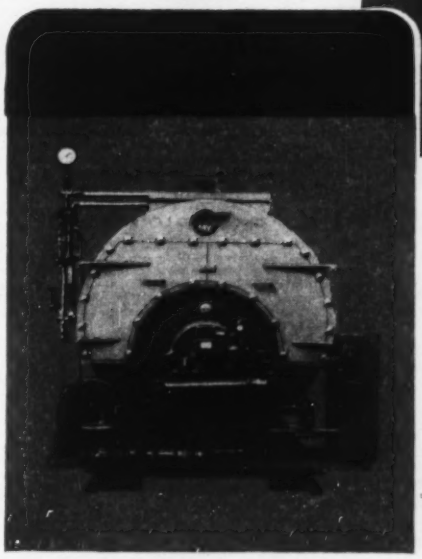
TITUSVILLE

INDUSTRY'S FINEST PACKAGE BOILER

... now with your choice of burners from 3 leading manufacturers!







Three complete boiler-burner packages—each in a full range of sizes—each with its own leading make of burner, handling oil, gas, or combination oil and gas—each with the TITUSVILLE boiler that assures maximum efficiency and dependability on the job! Whether your needs are for power or heat, whether you require one or a battery of modern package units, you'll find in *Titusville-Iron Fireman*, *Titusville-Petro* or *Titusville-Ray* the exact boiler-burner you should have. Write for descriptive Bulletins, today!

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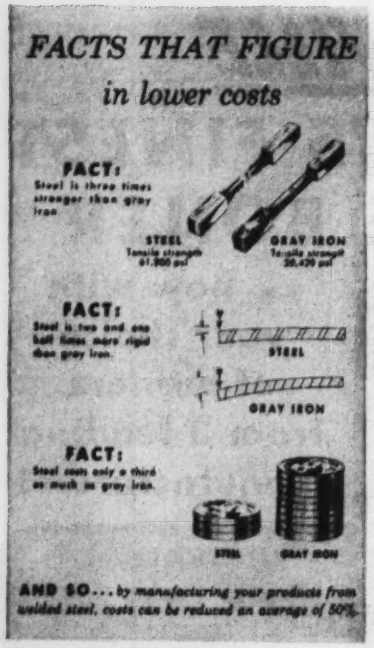
TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

Manufacturers of **A Complete Line of Boilers for Every Heating and Power Requirement**

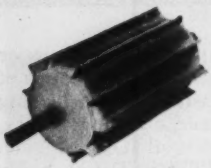

FACTS THAT FIGURE
in lower costs
FACT:
Steel is three times stronger than gray iron
STEEL
GRAY IRON
FACT:
Steel is two and one half times more rigid than gray iron.
STEEL
GRAY IRON
FACT:
Steel costs only a third as much as gray iron.
STEEL
GRAY IRON
AND SO... by manufacturing your products from welded steel, costs can be reduced an average of 50%

HOW YOU CAN CUT COSTS...NOW

BECAUSE steel is stronger, more rigid than iron, yet costs a third as much per pound, costs on many products can be cut up to 50%.

Savings like this can be realized on *your* products without disrupting production. Simply change over your designs one part at a time.

COSTS 45% LESS



Feeder roll is built from standard channel welded to steel discs. Steel design eliminates breakage, weighs half of former casting. Saves 45% on cost of manufacture.

COSTS 30% LESS

Machine bracket is welded from 10 gauge metal. Weighs half as much as original cast design. Costs 30% less to produce.

A Lincoln representative will gladly work with you to cut your production time. He can show you how to simplify design details . . . cut costly man-hours. Call him or write on your letterhead.

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THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

YOUR New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

205 LIGHT-METAL CASTINGS

Thompson Products, Inc., Light Metals Div.—An 8-page booklet, "Creative Castings for Industry," describes Thompson's light-metal casting facilities and includes photographs of typical parts. Stages of casting, from delivery of ingots to delivery of finished parts, are illustrated.

206 DUAL DRIVE ADAPTER

F. W. Stewart Corp.—Bulletin describes "Circle Ess" Dual Drive Adapter for use in conjunction with flexible shaft drives where more than one unit is to be driven from the same power source; to provide two ratios from the same source or to facilitate attaching flexible shaft drives where limitations in space prevent direct connection without bending the shaft to the point of possible damage. Furnished with standard $^{1}/_{2}$ in. × 18 threaded connections with 0.104-in. internal square drives and in ratios or 1 to 1, 15 to 1, 16 to 1, and 17 to 1 for either left or right rotation.

207 CONVEYING SYSTEMS

Fuller Co.—Bulletin G-1, 8 pages, pictures and describes four basic types of conveying systems built by the company for moving dry, pulverized materials. Diagrams showing how systems work are included, and miscellaneous equipment is pictured and described.

208 SOLENOIDS

National Acme Co.—Bulletin EM-52 is a 28-page illustrated catalog of Namco "Stellite"-Welded Solenoids, designed with heavy covers and a reference tab for insertion in $8^{1}/_{2}$ × 11-in. files. Specifications, applications, ordering instructions, engineering data, and accessories and parts lists are included.

209 BRONZE BEARINGS

Chrysler Corp., Amplex Div.—Bulletin S-53 describes and illustrates 700 Oilite Bronze Bearings and Oilite Cores, Bars, and Plates stocked "for immediate delivery" by Oilite dealers and depots throughout United States and Canada. In addition to manufacturing and technical data, the catalog gives instructions for machining Oilite bronze, finishing the bore, handling of bearings, the other tabular processing information.

210 ELECTRICAL PRECIPITATORS

Research Corp.—Illustrated General Bulletin, 28 pages, describes Cottrell theory, methods, types, and specific applications in a variety of industries, including power, steel, chemical, paper, metallurgical, gas, oil, and carbon black.

211 SNAP RINGS AND LOCK WASHERS

Eaton Mfg. Co.—Catalog describes designs and applications of their complete line of (1) snap, bearing, lock, and retainer rings; (2) spring lock washers preassembled on bolts or screws, also self-tapping types; and (3) spring lock washers. Also included are tables of dimension specifications, and installation instructions.

212 INDUSTRIAL SPRAY NOZZLES

Spraying Systems Co.—Catalog No. 24, a new spray nozzle catalog, contains capacity and spray characteristic data. Said to be the most complete industrial spray nozzle catalog ever produced, it illustrates nozzles for producing hollow cone, full cone, flat, solid stream, and pneumatically atomized sprays. Nozzles made of special materials are also illustrated with capacity tabulations, such as nozzles with wearing points reinforced with tungsten carbide.

213 INDUSTRIAL TIMERS

Industrial Timer Corp.—4-page catalog shows pictures and complete description of time-delay timers, interval timers, re-cycling timers, running-time meters and reset-time totalizers. All timers are synchronous motor driven.

214 INDUSTRIAL SPRINGS

Henry Miller Spring & Mfg. Co.—Booklet shows examples of springs, equipment and facilities. Railroad, coke ovens, mine cars, tractors, presses, shears and for other uses in industry. Illustrations of various springs and applications. Helical carbon-steel spring formula ARA and test loads in pounds and deflection per turn table.

215 HEAT EXCHANGER

Bell & Gossett Co.—Catalog No. DM-1150 contains an extensive table of applications to various industries of heat exchangers, heaters, coolers, and condensers, together with specifications and detailed applications of B & G's principal models. Refrigeration equipment, centrifugal pumps, gas coolers, and water heaters are included. Eight pages of engineering data are in the 28-page booklet.

216 PACKINGS

United States Rubber Co.—Complete catalog covers recommendation charts, describes sheet packings, gaskets, rod and plunger packings, hydraulic, flax, jute and ramie, locomotive and specialized packings. Also pump valves, miscellaneous packings. Fully illustrated. Tables and engineering section. Index covers entire line.

217 TOOL STEELS

Vanadium-Alloys Steel Co.—One of a series of bulletins covering specific groups of tool steels manufactured by Vanadium is offered. It gives the uses, compositions, and heat treatments of the following tool steels: Colhed, Par-Exc, Silman, Mosil, Cm, Croman, Nikro M, and Speed-Cut. The booklet also discusses pertinent metallurgical characteristics.

218 GAGES AND THERMOMETERS

Marsh Instrument Co.—Catalogs No. 76-G and 76-T describe in detail a wide line of industrial gages and thermometers. The catalogs are fully illustrated, including cut-away photographs and enlargements of internal parts. They cover also gage accessories, specifications including line drawings and dimensional tables, and templates covering every size and pattern.

219 FLEXIBLE SHAFTS

Stow Mfg. Co.—Engineering Bulletin No. 525 and Slide Torque Calculator show how to select the correct size and type power-drive flexible shafts for any application (maximum capacity 1500 lb-in.). Also given is the necessary data for selecting remote-control flexible shafts (maximum capacity 4000 lb-in.).

220 HIGH-SPEED MOTION PICTURE CAMERAS

Wollensak Optical Co.—An 8-page pamphlet describes the operation and uses of the Fastex high-speed cameras used in research, commercial engineering, and medicine. These cameras are a continuous-moving film type with rotating prism positioned between the lens and the sprocket. They are available in 8, 16, and 35 mm., in both 100- and 400-ft. capacity and are capable of taking pictures at rates of 150 to 160,000 frames per sec.

Read carefully . . . select wisely, then send coupon on page 44 now for your free catalogs. Requests limited to 25 catalogs. (Sorry, no catalog distribution can be made by us to students.)

YOUR *New Catalogs* GUIDE

221 PLANT DESIGN

Graver Construction Co.—A 4-page brochure outlines the company's activity in the design, engineering and construction of chemical plants, refinery units, steel plants, water facilities, gas and crude pipeline stations and floating pump stations.

222 AUTOMATIC BOILERS

Orr & Sembower, Inc.—Literature has been announced to cover the company's extension of its Model 4 line of packaged automatic boilers through 100 hp size. The line is being constructed for light oil firing, gas firing, and for combination gas or oil firing.

223 RECORDING ANALYZERS

Mine Safety Applicance Co.—Folder describes infrared gas and liquid analyzer for rapid automatic analysis of fluid mixtures, for precise process control and for mixing toxic contaminants in atmosphere. Other bulletins cover oxygen indicators, gas alarms and CO_2 recorders.

224 AUTOMATIC VALVES

A. W. Cash Valve Mfg. Corp.—60-page catalog describes and illustrates line of pressure reducing and regulating valves, relief valves, back pressure valves, vacuum regulators and vacuum breakers, differential pressure regulators, strainers, and diaphragm operated control valves. Contains 16 new items not previously included in former catalogs.

225 NYLON BEARINGS

Thomson Industries, Inc.—Advantages of nylon as a bearing material, particularly where bearings must operate without lubrication, are explained in a catalog which also contains engineering data, installation information and a bearing evaluation chart. The literature describes a number of special type nylon bearings which are available on special order, as well as the company's standard lines.

226 SPRINKLER SYSTEMS

"Automatic" Sprinkler Corp. of America—"The ABC of Fire Protection" is a 36-page illustrated booklet on the advantages of installing sprinkler systems, emphasizing probable savings in insurance. Operation of various types of fire protection systems is explained and their advantages described. Photographs of buildings and ships using "Automatic" systems are included.

227 SHEAR SELECTION

O'Neil-Irwin Mfg. Co.—Faster, easier ways of selecting, setting up and operating Di-Acro shears are described and illustrated in a new 14-page booklet. Booklet points out many different materials that can be sheared: plastics, fiber, mica, leather and rubber to heavy gages of aluminum, chrome molybdenum, leaded brass, stainless steel and other spring tempered materials. Specifications and capacities are listed in tables on four hand and four power operated precision shears with material capacity of 16 gage mild sheet steel.

228 LIQUID METERS

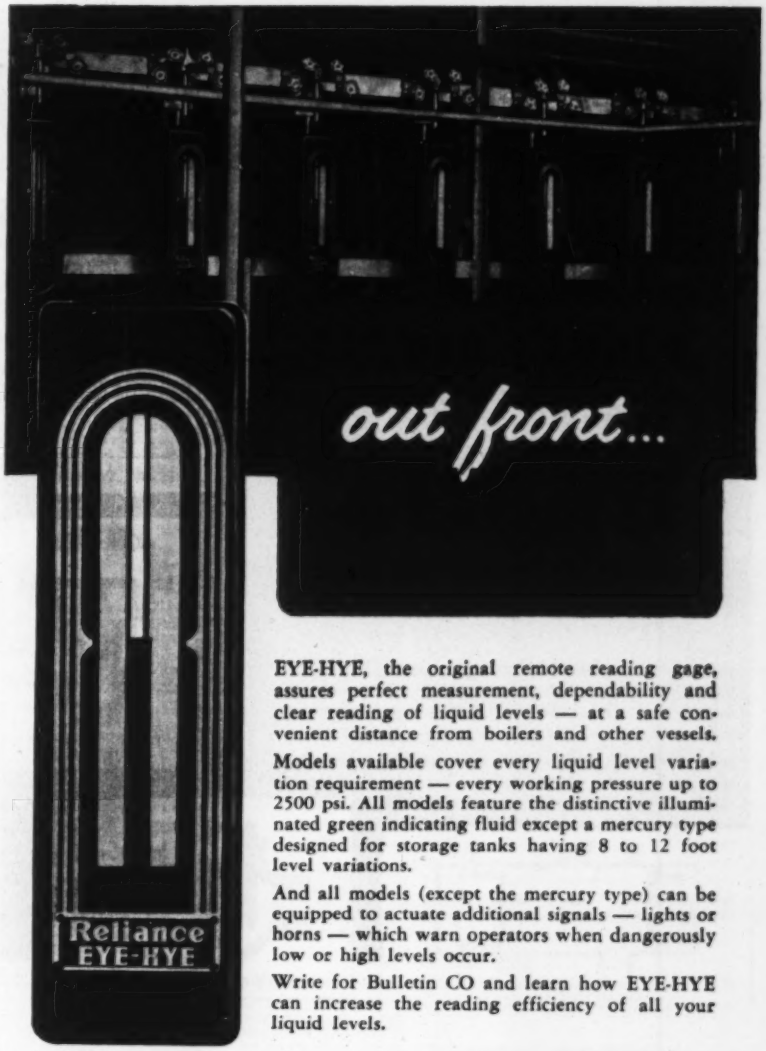
Neptune Meter Co.—New 20-page bulletin describes meters for handling over 100 industrial liquids in processing, batch mixing, cost control operations. Includes Auto-Stop meter with automatic quantity control for accurate formulas. New meter-selector charts give complete selection and specification data for over 30 different liquid meters. Capacities from 2 to 1000 gpm, temperatures to 250 F, pressures to 500 psi.

229 VALVES

Lunkenheimer Co.—The new 500-page Lunkenheimer Catalog No. 53 features a three-color illustrated Guide section, where popular valves are grouped by pressure classes for easy comparison. More complete details can be found by referring to the four-way index. Dimensions, prices, and performance data of valves are contained in the catalog.

230 OIL BURNERS

Cleaver-Brooks Co.—Oil Burner Catalog No. AD-102 includes a description of the Hev-E-Oil Burners for industrial, commercial, and institutional installations. The catalog lists features, shows typical installations and applications, covers design construction and efficiency, and contains brief capacity and dimension listing.



EYE-HYE, the original remote reading gage, assures perfect measurement, dependability and clear reading of liquid levels — at a safe convenient distance from boilers and other vessels.

Models available cover every liquid level variation requirement — every working pressure up to 2500 psi. All models feature the distinctive illuminated green indicating fluid except a mercury type designed for storage tanks having 8 to 12 foot level variations.

And all models (except the mercury type) can be equipped to actuate additional signals — lights or horns — which warn operators when dangerously low or high levels occur.

Write for Bulletin CO and learn how EYE-HYE can increase the reading efficiency of all your liquid levels.

The Reliance Gauge Column Co.

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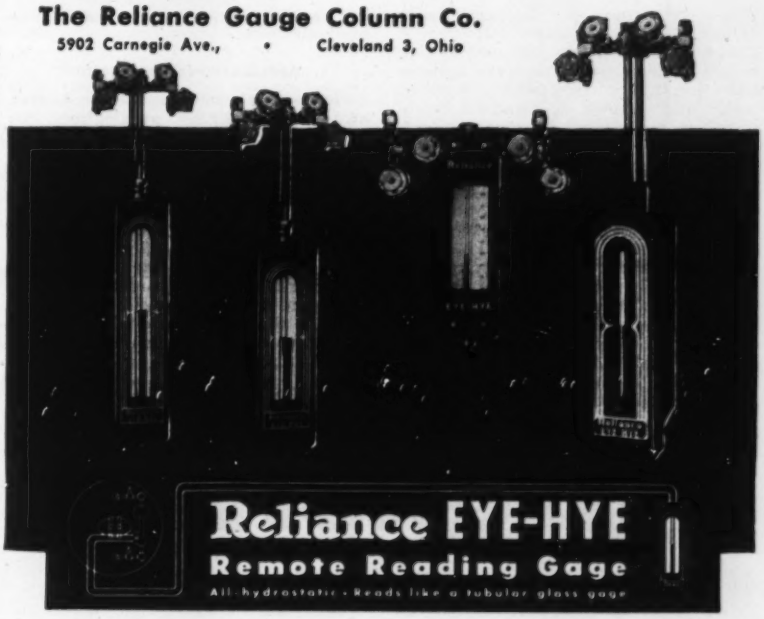
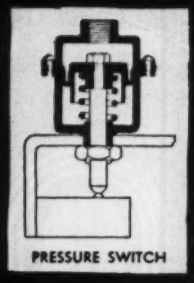
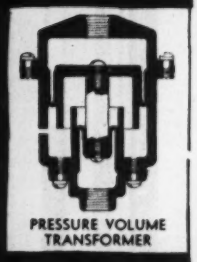


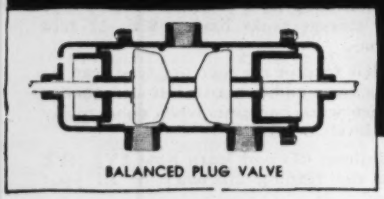
Bellofram*



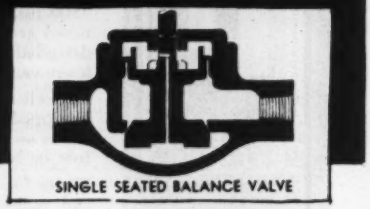
PRESSURE SWITCH



PRESSURE VOLUME TRANSFORMER



BALANCED PLUG VALVE



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APPLICATIONS UNLIMITED

Bellofram seals may be used in almost any piston-cylinder application, for either precision measurement or frictionless power. Infrequent replacement is the only maintenance. Effective area can be controlled to within less than 0.1% over the working stroke. Efficient operation can be obtained at pressures varying from inches of water to 500 PSIG max. over a wide temperature range. Plan to incorporate Bellofram seals into both your old and new designs. A sketch of your device will help us help you. Strict confidence observed. Write today.

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231 BULK STORAGE TANKS

Graver Tank & Mfg. Co.—New 16-page booklet describes manifold uses of standard bulk tanks in storing petroleum products, chemicals, water, solvents, etc., ranging in capacity from 550 to 30,000 gallons, designed for installation vertically, horizontally or underground. Lists all standard sizes and capacities and provides useful gage tables

232 GAS UNIT HEATING

Reznor—Technical and application data on the use of gas unit heating is illustrated and described in a 20-page bulletin, SA-541. Diagrams and tables outline specifications, gas line requirements, and heat loss estimating factors.

233 ASH SLUICING SYSTEMS

United Conveyor Corp.—Bulletin No. 2S 50 on ash sluicing systems, features the latest developments on hydraulic transportation of ashes, fly ashes, and soot with Jetpulsion pump, which eliminates entirely the use of mechanical ash pumps.

234 SERVO SYSTEM

Richardson Scale Co.—4-page technical reference pictures and describes a recently-developed servomechanism system composed of a synchromechanism, control transformer, servo amplifier and servo motor. Construction features and operating characteristics are listed, along with photographs and engineering drawings of key parts.

235 DUST, FUME CONTROLS

Mechanical Industries, Inc.—A technical paper, outlining a simplified and economical approach to the problem of collecting cupola dust "dry," includes diagrams, graphs and performance information on the company's dust collection system in operation.

236 REMOTE CONTROL

American Chain & Cable Co.—Bulletin No. DH-287 entitled "The Key to Remote Control—Tru-Lay, Push-Pull Flexible Controls" describes applications of various types of push-pull remote controls for installations ranging from delicate instruments to heavy earth-moving equipment. There is a question-and-answer section pertaining to construction, efficiency, backlash, deflection, temperature ranges, and weather resistance.

237 PUNCHES AND DIES

T. H. Lewthwaite Machine Co.—New, revised catalog sheets list the range of metal-working punches and dies carried in stock for immediate shipment. Styles to fit most makes of hand-, foot-, and power-operated punch presses are standard. Hand-operated punches, cutters, and benders are also illustrated and described.

238 ROLLER FOLLOWERS

Roller Bearing Co. of America—Catalog SF-80 describes the company's new roller followers. The unit is heavy walled, with rollers guided at their pitch line by a cage supported by integral flanges at the ends of the outer race to assure minimum coefficient of friction under heaviest impact loads.

239 VIBRATION FATIGUE TEST MACHINES

All American Tool & Mfg. Co.—16-page Catalog F54 describes the ten models of vibration fatigue test machines. Models for handling parts or assemblies from 10 lb to 150 lb in weight. Both horizontal and vertical table motion types. Manual or automatic frequency cycling.

240 PACKAGED AIR COMPRESSOR

Ingersoll-Rand Co.—Flier describes new compressor, Type PHE in 75 and 100 hp sizes as a heavy-duty, opposed-cylinder, balanced-design driven by a direct connected induction motor. It is a packaged, ready-to-run unit. Basic design is a two-stage 80–125 psi compressor. Other cylinder arrangements available for high pressures and vacuums.

241 ELECTRIC MOTORS

Robbins & Myers, Inc.—Bulletin No. 400 describes the R & M "All-Weather" motors. These motors can be installed anywhere, in any climate: in damp areas, in dusty or corrosive environment, the manufacturer declares. There are drip-proof and splash-proof polyphase motors from 1–125 hp; single-phase, 1–7½ hp; direct current, 1–7½ hp; totally enclosed, fan-cooled, 1–40 hp; and explosion-proof, 1–40 hp.

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242 SPEED CONTROL DRIVES

Link-Belt Co.—The company's PIV drives in eight sizes from 1/2 to 20 hp are described in 88-page book 2274. The drives are designed for quick adjustment for variable control over a wide range of speeds.

243 WATER TREATING EQUIPMENT

Hungerford & Terry, Inc.—Zeolite softeners and pressure sand filters are illustrated in bulletin V-111 which describes the company's poppet valve applicable for manual, push-button automatic, or fully automatic operation. Electric control panel for preventing two units from being out of service simultaneously on multiple installations is also described.

244 FIBERGLASS STRUCTURAL PANELS

Resolite Corp.—A new 4-page bulletin on plant daylighting describes the company's translucent structural panels of fiberglass-reinforced polyester resins, manufactured in 11 standard corrugations, including V-beam, 5-V crimp and flat sheets. It includes specifications, loading, light-transmission values and other characteristics of the material, as well as detailed drawings of installation methods and photographs of typical installations.

245 PUMPS, MOTORS, AND ACCESSORIES

Oilgear Co.—Bulletin 10051-D illustrates and describes a line of Fluid Power pumps, motors, transmissions, cylinders, and valves. It features an expanded line of variable and constant delivery pumps for operation at higher speeds, 1-hp variable-delivery pumps, constant-delivery duplex pumps for pressures up to 5000 psi, and a larger-capacity feed pump.

246 STEAM GENERATORS

United States Radiator Corp., Cyclotherm Div.—"All Your Questions Are Answered by Cyclotherm" tells story of patented "Cyclonic Combustion." Explains how Cyclotherm manufactures generators with only two passes; building smaller, more efficient boilers, yet still extract maximum heat from fuel used to fire package boilers from 10 to 600 hp.

247 PRESSURIZED MANOMETERS

Meriam Instrument Co.—Bulletin No. 28 describes fully their pressurized manometer. Reduces high pressure measurement to hand valve operation. Makes for greater accuracy in calibration of gages as well as direct reading of higher pressures encountered in turbine engine development, high torque measurement and other research projects. Shows principles of operation, description, total pressure manometer, models. Schematic flow diagram included.

248 BIN LEVEL INDICATOR

Bin-Dicator Co.—New 1954 catalog fully describes and illustrates bin level indicator which gives automatic control of machinery in response to fluctuating level of materials in silos, bins, hoppers, conveyers, etc. Dimensional drawings, mounting details, typical applications, wiring diagrams, and list of present users. Illustrated applications to stoker operation, flour packing, chemical proportioning, concrete mixing plant, packaging ores, salt, feed, chemicals, candy, etc.

249 SPECIALIZED EQUIPMENT

L. O. Koven & Bro.—Bulletin No. 550, color, illustrated, contains descriptions of specialized equipment manufactured such as: mixers, kettles, vacuum and pressure vessels, autoclaves, evaporators, impregnators, condensers, stills, extractors, tanks, stacks, piping.

250 LUBRICANTS

Rockwell Mfg. Co.—Bulletin No. V-220 describes lubricants, lubricant fittings, lubrication equipment and methods for Rockwell-built Nordstrom valves. Three major types of lubricant, Rockwell Hypermatic, Nordcoseal, and Lubricant DC-234, are covered, with an instruction chart showing which lubricants are recommended for use with a variety of fluids. The bulletin also illustrates and briefly describes the new Rockwell bulk and gun tube lubricants, along with stick and bulk lubricants.

251 TURBINE-TYPE AND CENTRIFUGAL PUMPS

Aurora Pump Co.—8-page catalog and selection guide illustrates and describes turbine-type and centrifugal pumps in various combinations of capacities, heads and designs, including deep well turbines and condensate return units. Features, construction specifications, applications and condensed selection information are given for each pump unit.

252 GROOVING TOOL

Waldes Kohinoor, Inc.—Catalog No. GT2-53 presents general information, engineering specifications, and manufacturing technical data for the Waldes Truarc grooving tool. The manual is illustrated with a number of tool setups and explains the functioning of the tool, particularly its economic performance on recessing operations. It also includes typical applications, dimensions and conversion tables, and ordering specifications.

253 SPEED REDUCERS

Westinghouse Electric Corp.—File No. 3600 describes their line of speed reducers. Types and applications are shown in illustration. Details of construction, standard ratios, and high power transmission efficiency are covered as well as engineering and maintenance service.

254 VENTILATING-HEATING UNITS

Trane Co.—"Unit Ventilators," Bulletin DS-340 shows the Trane Unit Ventilator system with wall-to-wall kinetic barrier action, as well as conventional Unit Ventilators. Construction, mechanical, and architectural specifications are given. Also included are illustrations of cycles of operation, roughing-in dimensions, application suggestions, and both hot-water and steam capacities.

255 METAL CHIP CONVEYORS

National Conveyors Co.—New Bulletin contains illustrations, line drawings and descriptive data on "Chip Veyor" systems. Shows how metal turnings are crushed, conveyed and stored and how valuable cutting oil is reclaimed for re-use.

256 FORGINGS

United States Steel Corp.—A 28-page booklet "USS Quality Forgings Fully Prepared to Do the Tougher Job," illustrates and describes the

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forging of generator, turbine, and waterwheel forgings, anvil bases and columns, forged shafts, forged steel rolls and sleeves, and forged blooms, billets, and rounds. The booklet closes with a brief history of forging.

257 OIL FILTERS, STRAINERS, OILING DEVICES

Wm. W. Nugent & Co., Inc.—Seven bulletins: No. 6 illustrates and describes Nugent pressure strainers; No. 7, gravity filters; No. 7A, pressure filters; No. 8, tanks, pumps, shaft oilers; No. 14 oiling and filtering systems for turbines, paper mills, steel mills, pumps, compressors; No. 15, oiling devices; No. 16, sight feed valves, multiple oilers, flow indicators, sight overflows, and compression union fittings.

258 SELECTION OF TUBING

Tube Reducing Corp.—A four-page illustrated bulletin describes application advantages of different types of tubing. Comparative tensile strengths tolerances and surface finishes available in several types of tubing for product applications are discussed. Another section describes unique compression-forming method of cold working seamless tubes. Photographs show compression-forming, tube reducing machine and the wide range of shapes, tapers and inside contours produced.

259 ALLOY-STEEL SCREWS

Strong, Carlisle & Hammond Co.—Catalog No. 50 describes the Mac-it line of alloy-steel screws. 26 of the catalog's 36 pages contain technical information on the screws and screw products. Hexagon-socket screws, including knurled cap screws, flat-head cap screws, button head cap screws, shoulder screws, hollow set-screws, hollow lock-screws, and hollow pipe plugs, and other screw products, such as square-head set screws, tool-post screws, square-head collar cap screws, hexagon-head cap screws, stud bolts, milled studs, slotted headless set screws, slotted fillister-head machine and cap screws, slotted flat-head machine and cap screws, slotted round-head machine and cap screws, mining machine screws, and hexagon socket keys, are covered in the catalog.

260 ROOF TANK SEAL

Graver Tank & Mfg. Co.—A 4-page bulletin illustrates and describes the company's seal for floating roof tanks. The seal is composed of weighted arcuate pushers and spring-actuated hangers, each spaced alternately about 2 ft apart all around the roof's outer rim and connected to it. The unit's function is to hold the seal shoe tightly against the shell of the tank and to keep the roof centered within the tank.

261 LETTERING MACHINE

Ralph C. Coxhead Corp.—Bulletin tells how Vari-Typer lettering machine offers fast method of lettering bills of material, notes, specifications on tracings and drawings, and countless other drafting-room lettering details. A few of the many styles of instantly changeable type are illustrated.

262 POWER PRESSES

Kenco Mfg. Co.—One-page bulletin describes and gives specifications of new rigid rib type, deep-throat power presses, Models 4R and 5R, 4 and 5 tons, respectively.

263 ELECTRONIC COUNTERS, FEEDERS

Perry Equipment & Engineering Co.—An 8-page bulletin covers the company's line of vibrating machines, bowls, hoppers and electronic counters for use in metal working, processing, packaging and assembling. Engineering and dimensional information is included.

264 BLOWER WHEELS

Revcor—A 32-page illustrated catalog gives tables of dimensions and performance data under test conditions of the NAFM Code of a line of single- and double-inlet blower wheels. There is also a section on sheet-metal housings to fit all their blower wheels. The catalog includes schematic diagrams and dimensions tables.

265 BOILER SERVICE VALVES

Everlasting Valve Co.—Bulletin describes the Everlasting Quick-Opening and Slow-Opening Straightway Valves, Angle Valves, Y Valves, and Duplex Blow-Off Units, with specifications, materials of construction, and dimensions of each type. Illustrations include details of design, sectional and exploded views, and explanations of operation of the valves. A section of the bulletin also describes Everlasting Valves for fire protection.

266 ROLL FORMED SHAPES

Roll Formed Products Co.—Catalog No. 1053 shows the production procedure and advancements made by the company. Design and engineering data is given, along with a series of cross sections of various types of shapes made by the company.

267 MOTOR CONTROLS

Allen-Bradley Co.—Sixth Edition Handy Catalog, thumb-indexed for quick selection is a 120-page booklet which contains listings for most frequently used items in their line of motor controls.

268 HEAT EXCHANGERS

Lummus Co.—A 24-page booklet describes the company's heat exchanger division, illustrates methods of manufacture, outlines planning and research procedures, tells history of the division, and lists offices and sales representatives throughout the world.

269 SCREW MACHINE PRODUCTS

New Britain Machine Co., Precision Products Div.—A brochure outlines the company's facilities for the manufacture of precision hardened and ground screw machine products for aircraft engine builders and other manufacturers of mechanical devices and metal products.

270 FORCE-MEASURING DEVICE

Hagan Corp.—The Hagan "ThrusTorq," air-operated force-measuring device, is pictured and described in Bulletin No. 9345. The ThrusTorq is employed in engine-testing laboratories, engine and aircraft factories, automotive and petroleum industry laboratories and plants, and in chemical and other plants for continuous and intermittent weighing applications.

271 GEAR INFORMATION

Illinois Gear & Machine Co.—Catalog No. 39 contains useful tables and directions for ordering, and presents gears for every purpose; bevel, internal, mitre, spiral, spur and worm; also pinions and sprockets, produced under a shopwide quality control program.

272 VACUUM AND PRESSURE PUMPS

Leiman Bros., Inc.—Catalog 953 gives complete data on full line including 29.9 in. vacuum pumps, 25 psi pressure pumps, air motors (5 hp) and gas boosters. Also features the patented automatic E113 oiler, the use of ball bearings and illustrates various type units available.

273 INDUSTRIAL LUBRICATION

Brooks Oil Co.—An illustrated brochure which tells the story of the company and the varied applications and solution of lubricating problems in industry. Outlines various industries served. Under trade name of Leadolene it shows application on mill tables, mill pinions, circulating oil systems, hydraulic systems, open gears, enclosed gears and bearings, flexible couplings, wire rope, worm drives, high temperature lubrication.

274 COOLING TOWERS

Marley Co.—A 30-page, 3-color bulletin illustrates and describes the company's single-flow, double-flow and twin-flow cooling towers. Photographs and diagrams show typical installations and describe the operation of the units. Also included is data on the various design features of the towers and information on the company's application engineering service.

275 STREAMLINED BAFFLES

Engineer Co.—Bulletin BW 54 covers stream-lined baffles for all types of water tube boilers. Photographs and diagrams are used to describe the construction of the baffles for varying makes and types of boilers, furnaces and methods of firing.

276 TITANIUM ALLOY

Kennametal Inc.—Folder describes Kentanium, a new heat-resistant titanium alloy that resists thermal shock, withstands oxidation, and retains great strength at high temperatures (1800 F and above).

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277 SHEET METAL STRUCTURES

Lindsay Structure, Inc.—Catalog describes method of using "Pre-Tensed" sheet metal for buildings, rooms, partitions, truck bodies, housings for equipment. Explains principles, assembly method, applications. Diagrams and structure data, tables of weights. Drawings of component parts. Fully illustrated.

278 DRAWING PENCILS

Eagle Pencil Co.—Free sample of turquoise drawing pencil made with 100 per cent "Electronic" graphite. With it, comes a folder describing how it will sharpen to a needle point so strong and durable it will actually play a phonograph record.

279 COMMERCIAL COOLING TOWERS

Halstead & Mitchell—A new 16-page catalog contains new material on air-conditioning cooling tower applications, specifications, selection and installation. Operating characteristics of twenty of the company's units are listed. The catalog also contains a comprehensive table of cooling tower nominal ratings for both 78 and 75 F wet bulb temperatures, charts showing outlet water temperature plotted against wet bulb temperature, and tower capacity plotted against wet bulb temperature, and layouts for year-round operating and inside use.

280 TANKS

W. E. Caldwell Co.—Storage and processing tanks Catalog No.61 covering steel and wood tanks for every type of service—including capacities, illustrations, price data and technical information on elevated tanks for industrial use, fire protection and water systems—other standard and special designs for the various industrial uses.

281 TEMPERATURE REGULATORS

Spence Engineering Co.—4-page bulletin describes design features of company's temperature regulators. The units feature a pilot, combining both a pressure and thermal element which changes steam pressure for delivery according to demand requirements. A cut-away diagram with description of construction and parts of a typical installation is included.

282 NUCLEAR GAGES

Industrial Nucleonics Corp.—AccuRay B153 brochure describes radiation gages and automatic controls designed for rubber and plastic sheet, paper, boxboard, metals rolling, coating and impregnating industries. AccuRay gages detect and record variations in weight or thickness and trigger an auto control system when variations exceed tolerances.

283 MULTI-STAGE STEAM TURBINES

Murray Iron Works Co.—Bulletin T-122 describes Type UV multi-stage mechanical drive turbine for driving pumps, compressors, fans, blowers and any other mechanical drive. Available in from two to ten pressure stages and with a great many possible governor combinations. Units can be furnished with wide range of accessory equipment. For capacities up to 2500 hp and steam conditions up to 600 lb, 750 F TT., either condensing or non-condensing.

284 TECHNICAL BOOKS FOR ENGINEERS

Ronald Press Co.—Brochures containing detailed descriptions of current technical books on mechanics, engineering, aeronautics, industrial management, metallurgy, applied and physical sciences, etc. Practical reference works like the Ronald Handbooks, basic studies, and pioneering works on the latest engineering and scientific developments are included.

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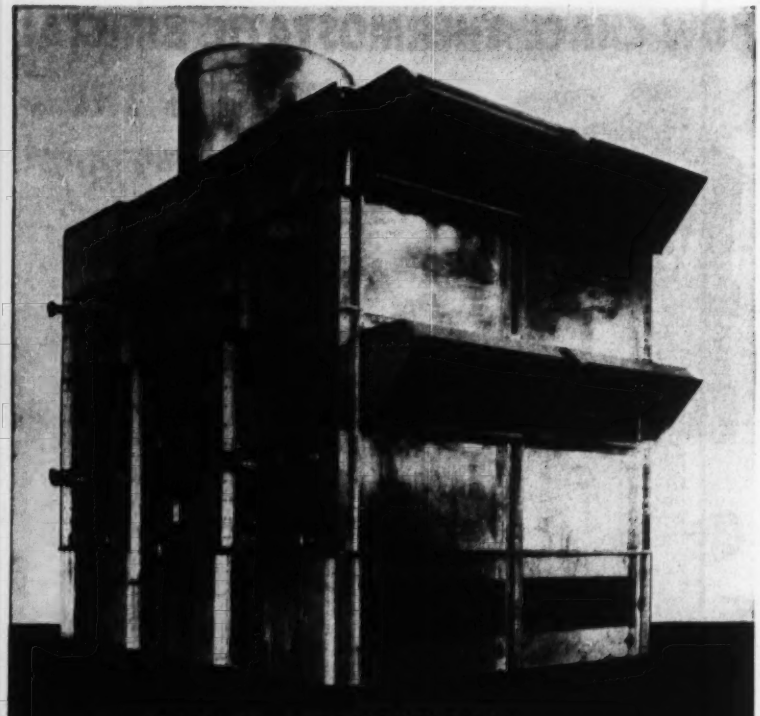

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285 MATERIALS HANDLING

Jeffrey Mfg. Co.—Catalog No. 860 describes experience covering nearly three-quarters of a century, studying handling and processing problems of industry and designing and manufacturing machinery to meet them. The results of service to many types of industries are embodied in this catalog. Describes full line of conveyors, feeders, gravimetric weighers, crushers, shredders, barrel packers, coolers, dryers, magnetic separators, screens, transmission machinery, elevators, power scoops, electronic controls, bin level indicators, rotary bin check valves, car pullers, chains and sprockets.

286 STEAM GENERATORS

Ames Iron Works, Inc.—Bulletin AXY-1 describes basic pressure vessel construction, boiler trim, auxiliary equipment and controls furnished on models A, X or Y steam generators.

287 FLOW CONTROLS

Hays Mfg. Co.—Flow data and specifications for the company's electroflo valves, mesurflo control, Straitflo strainer and Shur-Flo automatic interlock are contained in a 16-page bulletin. Catalog numbers, electrical, flow and switch data, and dimensional diagrams and flow charts are listed.

288 STEAM TRAPS

Clark Mfg. Co.—Information available on new development in steam trap construction, Duo-Step Leverage. By using an ingenious double-fulcrum point and venting mechanism it is now possible to increase the drainage capacity of a trap so that it may handle twice the condensate formerly possible

289 ELECTRIC RELAYS

Automatic Electric Co.—5 Circulars (1800-04 incl.) give engineering application data; specifications: dimensions, time range, voltages, contacts, etc., Class: "A"—all purpose relay; "B"—compacted relay for all mountings and services; "F"—quick-acting AC relay functions without specified operate or release time-delays; "S"—lighter, smaller relay for aircraft and similar shock and vibration resistance; "Z"—light, small relay where timing and other requirements preclude smaller "S" relay.

290 HOT WATER STORAGE HEATER

Patterson-Kelley Co.—48-page catalog pictures and describes horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, and low-flow design. Each cataloged as to weights, dimensions, construction details, and capacities, with conversion tables. Includes piping diagrams for high and low pressure steam systems. Also guide for setting up and connecting a storage heater. Average water requirements of typical hot water fixtures in various types of buildings with examples, how requirements may be calculated, capacity requirements determined and heaters specified.

291 CABLE CONVEYORS

E. W. Buschman Co.—Engineering data outlining the standard specifications of the company's cable conveyors is contained in a loose-leaf binder to which the company's product bulletins can be added. Cross sections, diagrams, data tables are included to guide in the selection of parts required for a power driven overhead trolley cable conveyor. Trolleys, completely fabricated turns, curves and self-contained power units are described.

292 SCREW JACKS

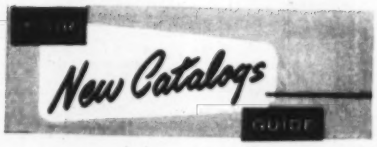
General Motors Corp., Saginaw Steering Gear Div.—Data book contains engineering data, efficiency chart, selection information and column load chart describing the company's ball bearing screw jacks. Also included are illustrations and information on the company's facilities for manufacturing this equipment.

293 FLEXIBLE METALLIC TUBING

Pennsylvania Flexible Metallic Tubing Co.—"Flexineering," 8-page illustrated data book, explains scientific application of flexible tubing for air, oil, steam, gases, volatiles. Application photographs, engineering data on steel, bronze, and aluminum tubing and hose in many types for product designers, engineers, equipment supervisors.

294 SLEEVE BEARINGS

Johnson Bronze Co.—A series of sleeve bearing data sheets discusses such subjects as powder metal-



lurgy, lubrication, conformability, clearances, standard tests, load-carrying capacity, corrosion, and alloys, and their consideration in sleeve bearings. Special sleeve bearings are included on the sheets.

295 DRUMS FOR CORROSIVE PRODUCTS

Pressed Steel Tank Co.—Catalog of complete line of tight and removable head drums and barrels designed for shipping dangerous and corrosive products. Unique crevice-free interior permits complete emptying, minimizes cleaning and eliminates the fear of product contamination. Available tailor-made to specifications of carbon steel, stainless steel, nickel, monel or other alloys.

296 ELECTRIC WELDING

Linde Air Products Co.—"Modern Methods of Joining Metals," 32 pages, explains and illustrates how metals are being joined efficiently by the Hellarc, sigma, and Unionmelt welding processes. It contains sketches and action pictures and shows welding on such metals as steel, stainless steel, aluminum, lead, cast iron, copper, and nonferrous alloys.

297 CIRCULATION HEATERS

Edwin L. Wiegand Co.—Bulletin 701 describes and illustrates the advantages and typical applications of a line of automatic electric circulation heaters. These units are available for controlled heating of water, oils, heat-transfer media, steam and air and other gases.

298 VIBRATION CONTROL

MB Mfg. Co.—Bulletin 420 describes and illustrates a complete line of vibration exciters and calibrators, vibration meters, automatic cycling systems and isolators.

299 TEST BOILERS

Besler Corp.—Test boiler bulletin, illustrated with photographs, drawings, and diagrams describes Besler high-temperature, high-pressure boilers. Designed by test engineers, these boilers are sectional, an innovation offering maximum flexibility, utmost weight and space conservation, and high efficiency. Bulletin contains specifications on 14 models with a range of capacities said to be heretofore impossible to attain.

300 GAGES

Sheffield Corp.—Catalog 126-53 has 24 pages devoted to Sheffield "Plunjet" Gaging Cartridge. Tells how to design and make your own air gaging and machine controls. Gaging ranges .001 to .040, amplification 125 to 5000 to 1. Describes a type of gaging cartridge used in conjunction with Sheffield Column and Dial Type Precisionaire Gages and other makes. Can be applied to a wide range of gaging, tooling and fixturing.

301 VALVE ACTUATORS

Ledeen Mfg. Co.—A 4-page folder illustrates and describes the company's valve actuators for use in standard flow line valves. Selection tables as well as catalog information is given, and such accessories as operating valves, pilot valves and air-hydraulic pumps are illustrated.

302 ALLOWABLE WORKING PRESSURES

Tube Turns—A technical bulletin contains data based upon the ASME Boiler Construction Code, 1952 edition, and the American Standard Code for Pressure Piping, ASA B31.1-1951, as revised by Supplement No. 1, ASA B31.1a-1953. Subjects covered are boiler code piping, power piping, industrial gas and air piping, oil piping within and outside refinery limits, district heating piping, refrigeration piping, plant process piping and hydraulic machinery piping.

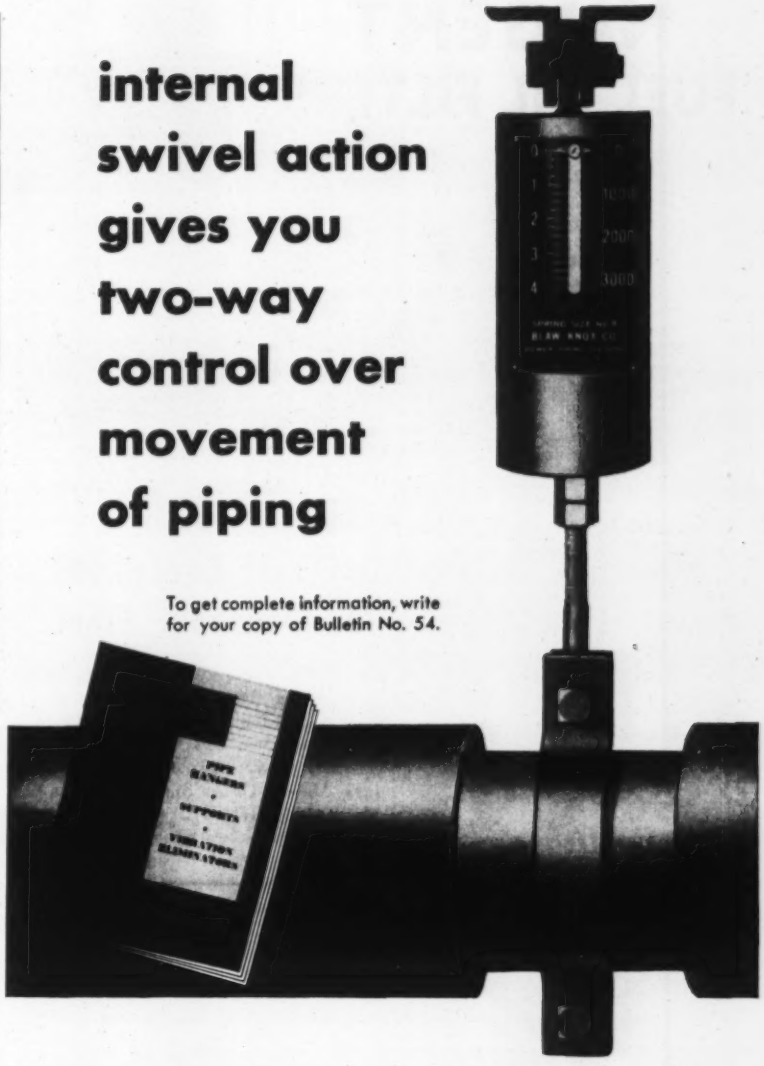
303 PUMPS

Aldrich Pump Co.—Catalog on reciprocating pumps, 10 to 2400 hp, includes data on direct flow pumps, 2½, 3, 5, 6-in-strokes series. 10 to 900 hp (3, 5, 7, and 9-plunger units); on Aldrich-Groff controllable capacity "Powr-Savr" pumps (5 to 125 hp); and on inverted vertical pumps, up to 2400 hp, 7 in. through 8½-in-stroke sizes.

304 HUMIDITY CONDITIONING

Surface Combustion Corp., Kathabar Div.—The company's system of humidity control in various industries is illustrated by case histories. Also included is a diagram showing how the system works and a table of optimum temperatures and relative humidities for a number of industrial operations.

internal swivel action gives you two-way control over movement of piping



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You can readily control both the lateral and longitudinal swing movements of your piping up to 7° with our functional spring hanger.

For the hanger is designed with the Blaw-Knox patented *internal swivel action*, which permits movement while the hanger case itself remains vertical. Larger movements are readily accommodated by overhead roller assemblies. Each is a complete packaged unit ready to install.

In fact, our entire line of rigid hanger assemblies, overhead roller assemblies, vibration eliminators, as well as the functional hangers, are furnished as complete units . . . thereby saving you engineering time and eliminating expensive cutting, threading and assembling in the field.

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Complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated power piping systems for all pressures and temperatures.

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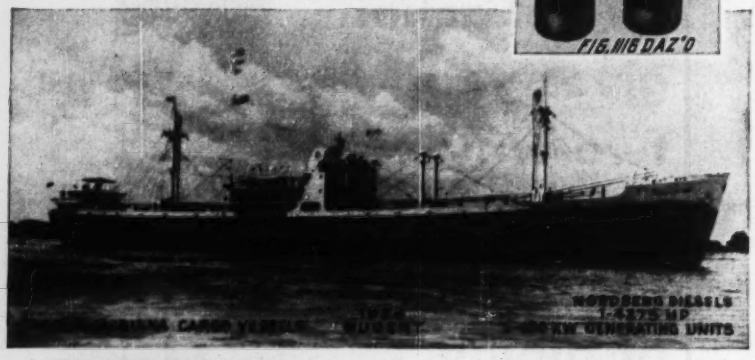

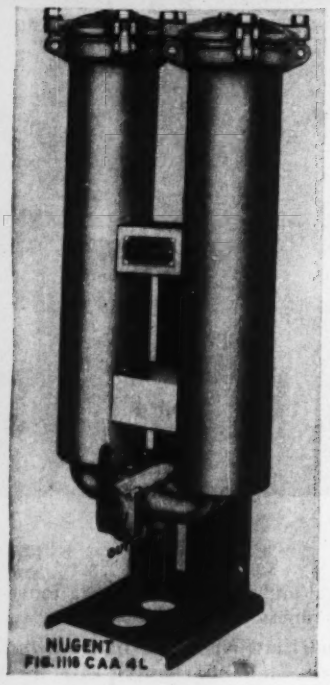

Shown above is a Nugent Duplex Fuel Oil Filter of the type installed as original equipment on the propulsion diesels serving the Flota Mercante vessels. Recharges are inexpensive bag type — easy to replace.

Original Equipment for Merchant Fleet

SHOWN above is the Ciudad de Cali, one of the newest in a fleet of Cargo ships built for Flota Mercante Grancolombiana, S.A. Each of these vessels is powered by a 4275 shp Nordberg Marine Diesel equipped with a Nugent Fig. 1116 CAA#4 Duplex Fuel Oil Filter. Auxiliary power on each of the vessels is supplied by a Nordberg Supercharged Diesel Generating Unit equipped with a Nugent Fig. 1116 DAZ#0 Duplex Fuel Oil Filter. The Grancolombiana installations are still another example of Nugent filters being included as original equipment by a leading diesel manufacturer.

By actual test, Nugent filters of the above types remove 99.8% of all foreign solids from the fuel oil supply. With either model, the duplex units can be operated in parallel; or one at a time to allow cleaning without interrupting operations. Slow manipulation of the valves will not cause stoppage or high pressure. These are only a few of the reasons why Nugent Filters are selected as original equipment by leading diesel engine manufacturers.

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Wm. W. Nugent & Co., Inc.
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YOUR New Catalogs GUIDE

305 GEAR REDUCERS

Falk Corp.—A 28-page catalog contains tables on the selection of the company's Motoreducers, and describes such models as all-motor horizontal, integral horizontal, all-motor vertical, integral vertical, all-motor right angle and integral right angle. Dimensional and weight data is given and standard accessories and modifications and low speed couplings are described.

306 MATERIALS HANDLING

Gifford-Wood Co.—A 32-page bulletin describes and illustrates specific industrial examples of the company's materials handling systems for bulk chemicals, metal-working, chemical processing, can manufacturing, brewing, foundry, textiles and coal handling in industrial plants.

307 AUTOMATIC CONTROLS

General Controls Co.—A 48-page, 2-color catalog illustrates and gives application and dimensional data on controls for air conditioning, fire protection, electric ignition systems, fans and water heaters. Included are meters, package sets, regulators, safety pilots, valves, thermocouples.

308 GAS TURBINE POWER PLANT

Westinghouse Electric Corp.—Bulletin B-5887 describes 500 kw power plant. A clear picture-book treatment covering both gas turbine and generator. Design features, cycle arrangements and application possibilities are included. Engineering data and clear guidance to assist application engineers.

309 HEAT RECOVERY

Catalytic Combustion Corp.—Reprints of three articles on heat recovery and fume disposal outline uses for catalysts in metal-working, foundry, plastics, rubber, chemical, electrical, and paint industries. "Catalytic Combustion Control for Core-baking Ovens," describes operating results with Catalytic Fume Disposal on foundry core ovens. "Profitable Use of Exhaust Fume" tells when and how to use fume energy to replace purchased fuel. "Gas Clears the Air" tells how gas may be used to recover "waste" heat on a 20-to-1 ratio.

310 HYDRAULIC PUMPS, MOTORS

Geroter May Corp.—A 4-page folder describes the company's standard models of hydraulic pumps and motors. Dimensional and performance data is given, along with selection tables and diagrams showing the operating principle of the equipment.

311 ELECTRICAL EQUIPMENT

Mission-Western Engineers, Inc.—A 42-page catalog gives dimensional and performance data and diagrams on the company's line of rotary electrical equipment, including a-c and d-c motors, fan assemblies, axial flow blower assemblies, centrifugal blower assemblies, generators.

312 STEELS

Sharon Steel Corp.—Two illustrated booklets describing Sharon 430 stainless steel and Galvanite—a zinc coated weather resisting steel. Chemical analysis, typical mechanical and physical properties, and fabricating characteristics are discussed. List of typical applications is appended.

313 SPEED REDUCER SYSTEMS

Sterling Electric Motors—A 4-page bulletin describes and illustrates the company's new speed reducers as capable of being mounted in any position without modification. The units are described as containing helical gears, positive oil seals, labyrinth seals, corrosion resistant gear case, dip and splash lubrication system, and low output shaft.

314 TEMPERATURE AND PRESSURE INSTRUMENTS

American Machine & Metals, Inc., Gotham Instruments Div.—Catalogs No. 101 ("Industrial Thermometers"), 200 ("Dial-Type Thermometers"), 400 ("Recorders"), and 500 ("Controllers") describe industrial and dial thermometers, and temperature and pressure recorders and controllers of both pneumatic and electric types.

315 GEAR REDUCERS FOR COOLING TOWER FANS

Lufkin Foundry & Machine Co.—Bulletin G-2 illustrates and describes a complete line of standard single reduction spiral bevel gear reducers especially designed for cooling tower fan drives.

YOUR *New Catalogs* GUIDE

316 CONTROLLED AIR-POWER DEVICES

Bellows Co.—Bulletin CL-50 reviews air, electric, and hydraulic control combinations. Air motors for pushing, pulling, holding; air-vises; rotary and shuttle-type work feed tables; drill press feeds and drilling units; and all types of valves and controls specifically designed for the automation of machinery, are described in this 36-page book.

317 TOGGLE SWITCHES

Minneapolis-Honeywell Regulator Co., Micro Switch Div.—Catalog No. 73b covers the company's line of 72 "AN" and/or "JAN" type toggle switches and 29 precision snap-action toggle switch assemblies. Illustrations, dimension drawings, characteristics, electrical ratings, outstanding features, general technical data and price and discount information are given on each switch.

318 LUBRICATION

Bijur Lubricating Corp.—A 16-page, 2-color bulletin deals with the lubrication of textile machinery and covers automatic lubrication of blending, picking, carding, combing, drawing, roving, spinning, twisting, spooling, knitting and weaving machinery.

319 ELECTRONIC FLOW METER

Hays Corp.—A 12-page bulletin describes the company's electronic flow meter system which includes a choice of mercury-less transmitters for measurement of differential pressure and of liquid level in an enclosed vessel. A description is also given of the transmission system, receiver, integrator, models and features.

320 STORAGE TANKS

Nooter Corp.—A 48-page catalog lists the many specialized techniques and services of the company in the custom fabrication of storage tanks and pressure vessels for the chemical, petroleum and processing industries. Corrosion data charts provide valuable information on resistance values of commonly used metals with reference to chemicals.

321 STORAGE HEATERS

Patterson-Kelley Co.—A 48-page catalog pictures and describes the company's line of hot-water storage heaters and presents information on piping arrangements and installation data. Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as a low-flow design are cataloged. Conversion tables and piping diagrams are included.

322 BULK MATERIAL VALVE

Stock Equipment Co.—A 4-page bulletin illustrates and describes the company's line of bulk material valves for bin, conveyor or spout outlet applications. Specifications are given and accessory equipment is described.

323 CAM CLUTCH

Morse Chain Co.—Catalog C11-54 describes new line of cam clutches for over-running indexing and backstop applications. Catalog describes cam principle, gives complete dimensional and engineering data as well as various adaptations of this line of clutches.

324 SCREW PUMP

Sier-Bath Gear & Pump Co., Inc.—6-page Bulletin SE-5 describes the company's external gear and bearing bracket type screw pump for non-lubricating fluids. Viscosity range is 32 SSU to 1,000,000 SSU; capacities 1-1000 gpm; discharge pressures 1000 psi for viscous liquids, 500 psi for water. The unit is designed for pumping fuel oils, crude oils, cellulosics, distillates, and water.

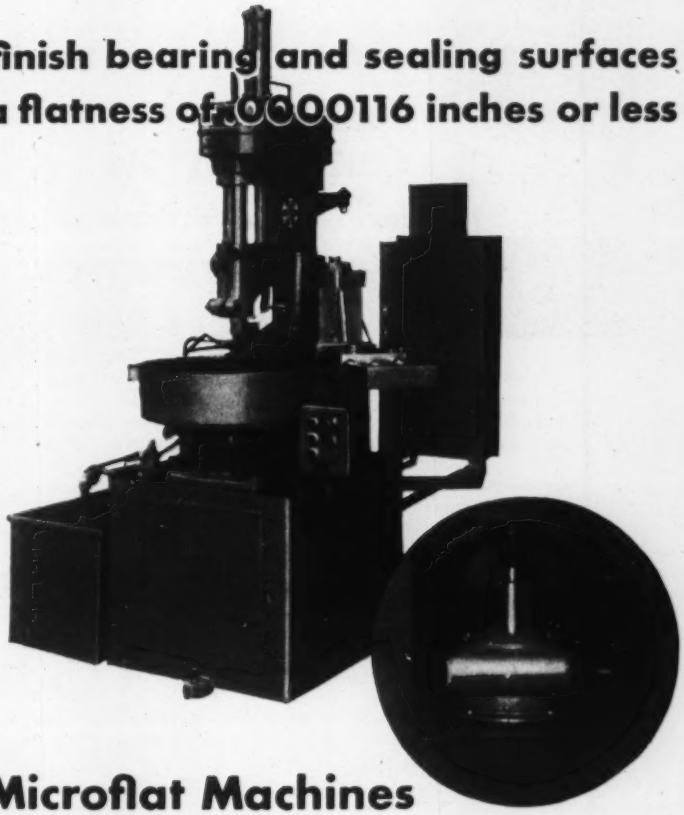
325 METEOROLOGY INSTRUMENTS

Bendix Aviation Corp., Friez Instrument Div.—A 23-page catalog, Bulletin No. 10, covers a variety of indicating, recording and control instruments for use in air pollution and other studies associated with meteorology. Included also are humidity and temperatures measuring and recording instruments for air conditioning and other applications.

326 HYDRAULIC VALVES

Rivett Lathe & Grinder, Inc.—Catalog Section 260 illustrates and describes the company's line of sub-plate mounted hydraulic valves, solenoid controlled pilot and solenoid controlled pilot operated. Also included are diagrams and specifications on piston designs and flow operations of the valves.

to finish bearing and sealing surfaces to a flatness of .00000116 inches or less



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Whether it's soft non-ferrous metal, hardened steel or ceramic . . . any flat surface that can be machined, can be finished to any desired degree of flatness and surface finish on this Microflat Machine.

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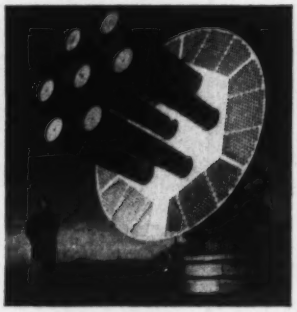

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New Catalogs GUIDE

327 DUST COLLECTOR

Western Precipitation Corp.—Design features, specifications and performance data on the company's reverse-jet dust collector is given in a 12-page illustrated booklet. Another booklet describes and illustrates the company's hollow-flight processor, a heat exchanger for cooling, heating, cooking and drying for the process industry.

328 VIBRATING EQUIPMENT

Jeffrey Mfg. Co.—Catalog No. 870 describes the company's line of electrical and mechanical vibrating equipment. It includes principles of design and operation, general dimensions and specifications of capacity feeders, vibrating conveyors and processing equipment.

329 ELECTRIC MOTORS

Miehle Printing Press & Mfg. Co., Star-Kimble Motor Div.—A series of bulletins illustrates and describes, with cutaways and performance charts, the company's polyphase squirrel-cage motors, wound-rotor induction motors, a-c single-phase repulsion motors, a-c and d-c brake motors, d-c motors and generators and motor-generator sets.

330 BUSHINGS, BRUSHES

Graphite Metallizing Corp.—A series of pamphlets bound in one cover describe the company's Graph-alloy, a self-lubricating material, and presents product information on its use in bushings, brushes, contacts, seal rings.

331 AUTOMATIC CONTROLS

Viking Instruments, Inc.—Catalog No. 646 describes the company's equipment for safety controls, alarm systems, special indicator systems, automatic plant equipment for internal combustion engines and industrial applications. Additional bulletins, 353, on a detector for porosity in dielectric sheet material, and 854, on liquid level controls, are also offered.

332 WELDING

American Welding & Mfg. Co.—Catalog 1P-10 describes the company's production facilities and lists and illustrates the types of forming, welding and machining equipment, as well as a variety of rings, bands and weldments, produced by the company.

333 AIR CONDITIONING EQUIPMENT

Servel, Inc.—Catalog describes Servel gas, electric, oil and steam operated air conditioning equipment and supplies specifications, dimensions and other application data. Equipment included are summer air conditioning for adding to existing heating systems, all-year air conditioners with both cooling and heating, self-contained air conditioners for business and industry, 25-ton water chillers for process cooling and air conditioning, supermatic compressor units for custom air conditioning and evaporative water coolers.

334 NICKEL ALLOYS

International Nickel Co., Inc.—"Engineering Properties of 'S' Monel" summarizes composition, properties, and working instructions of this age-hardenable, corrosion-resistant casting alloy. Included are charts and tables and specification data.

335 LEATHER PACKINGS

C. W. March Co.—A 52-page handbook on the design and application of mechanical leather packings, is illustrated with blueprint reproductions and covers leather cup packings, flange packing, U and V packings, gaskets, washers and diaphragms, service, installation and maintenance data. Material was assembled by American Leather Belting Assn.

Fill in and Mail the coupon on page 44 without delay.

YOUR *New Catalogs* GUIDE

336 AXIAL FANS, BLOWERS

International Engineering, Inc.—Bulletin 103A shows new "Code" capacities, exhaust, duct, extended shaft fans and power roof ventilators. Bulletin 109A shows stack boosters and duct booster fans, and bulletin 104A describes the company's axial blowers.

337 TRANSMISSION EQUIPMENT

Stearns Magnetic, Inc.—An 8-page bulletin covers applications, torque considerations, magnetic clutches, magnetic clutch brakes, and magnetic brakes manufactured by the company.

338 TANK GAGES

Liquidometer Corp.—A 4-page bulletin illustrates and describes the company's hydraulic, hydrostatic and direct reading gages for determining the contents of tanks.

339 VALVES

Cla-Val Co.—A general catalog illustrates and describes the company's valves of the following type: vacuum relief, pressure relief, combination back-pressure and check, power check, hydromatic check, pressure reducing, float, emergency fuel shutoff and altitude.

340 ASPHALTIC COATINGS

Insul-Mastic Corp. of America—A 44-page booklet describes the various reinforced asphaltic coatings marketed by the company. The book includes specific properties of these coatings and contains photographs showing suggested uses.

341 ELECTRONIC WEIGHING

Streeter-Amet Co.—An article reprint, "Determining Weight Electronically," outlines and illustrates basic scale systems, limitations, power supplies, circuit shielding and instrumentation in the use of electronics for determining weight in such applications as cranes, railroads, and hoppers.

342 LUBRICATION

Shell Oil Co.—Illustrated, 80-page booklet covers "Machine Tools and their Lubrication." Included are a short history of machine tool development, description of forces and types of motions encountered, and the role played by lubricants in modern machine tool operation and maintenance. Lathes, milling machines, grinders, drills, broaches, tapping machines, planers, shapers, slotters, and contour cutting machines, and hydraulic systems are discussed.

343 LOW-TEMPERATURE TESTING

Arthur D. Little, Inc., Mechanical Div.—A 6-page folder describes the company's helium cryostat as a basic instrument for cryogenic research which liquefies helium and maintains a test chamber from normal room temperature to within 2 deg of abs O.

344 VALVES

Ledeen Mfg. Co.—A 16-page catalog illustrates the company's line of valves for air, oil, gas and water. Operating and flow cycles and pilot valve circuits are diagrammed. Included in the line are pilot valves, solenoid operated valves, power operated valves, foot valves and hand valves.

345 COMBINATION BURNER

North American Mfg. Co.—Bulletin 221, in color, describes a dual-fuel sealed-in burner for industrial heating jobs fired with gas or light oil. Bulletin includes piping arrangement, photographs dimensions, capacities, and information for applying flame safety equipment.

346 METALWORKING MACHINES

O'Neil-Irwin Mfg. Co.—A 36-page catalog describes how Di-Acro precision metalworking machines perform forming, cutting, and punching operations in medium and lightweight materials. Benders, brakes, notchers, punch presses, rod parters, rollers, spring winders, press brakes and shears are listed in 44 hand- and power-operated models. Machine specifications and material capacities are arranged in tabular form for reference.

347 LEATHER, RUBBER PACKINGS

E. F. Houghton & Co.—Leather and rubber packings and precision parts are described in a folder, "One Source for All your Close-Tolerance Molded Parts and Packings." Leather packings, new rubber impregnated leathers, precision molded rubber, synthetic rubber packings and O-rings are included.

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Sylphon and Bridgeport bellows assemblies are used in many ways—for thermostatic devices, pressure controls, hydraulic mechanisms, expansion joints, as flexible connectors and in more applications.

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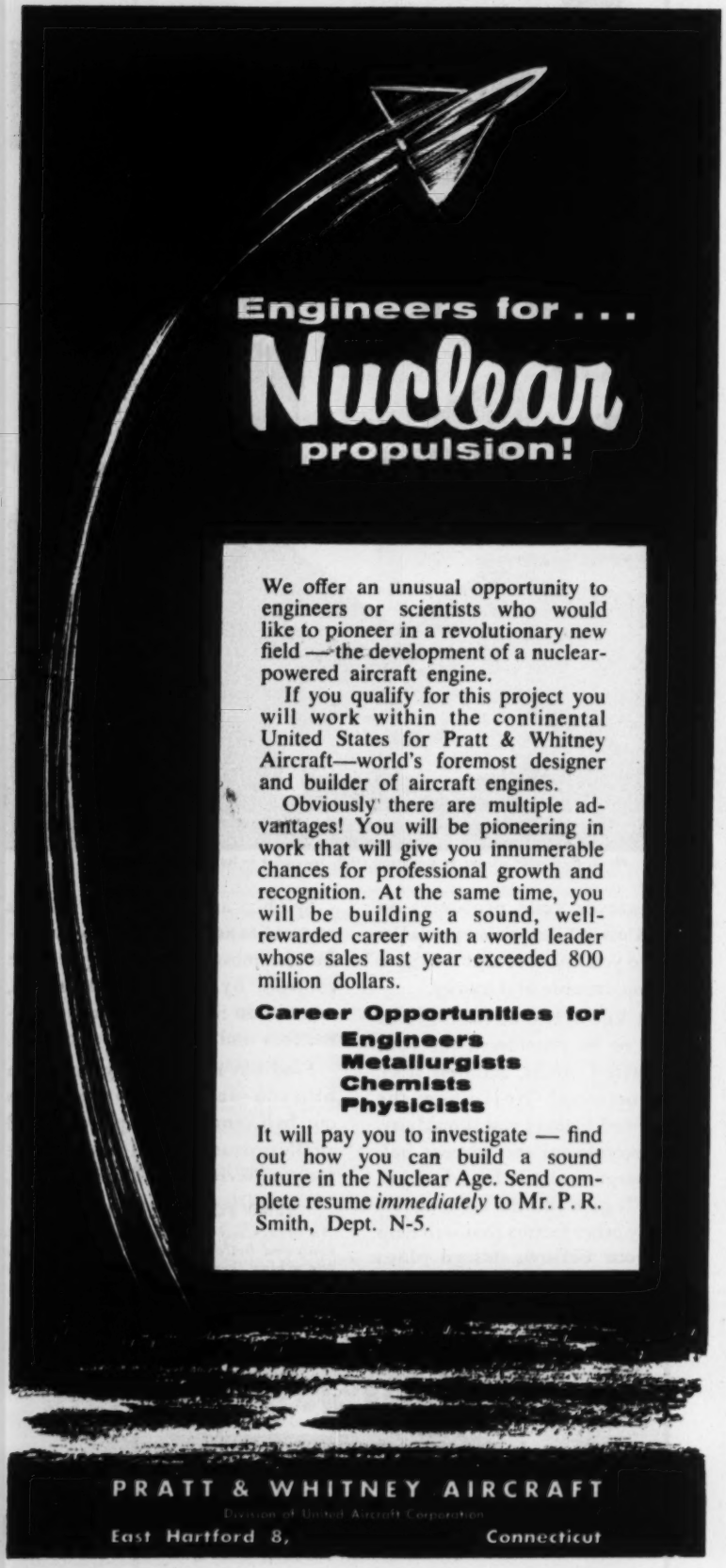
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PRATT & WHITNEY AIRCRAFT
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East Hartford 8, Connecticut

348 ELECTRICAL TIMING EQUIPMENT

A. W. Haydon Co.—A loose-leaf catalog illustrates and gives application and specification data on the company's time delay relays, repeat cycle timers, interval timers, time switches, elapsed time indicators, motor driven counters, chronometric d-c motors, synchronous a-c timing motors.

349 DUST COLLECTION

Kirk & Blum Mfg. Co.—A 28-page booklet, illustrated with case histories of applications, covers the company's equipment and engineering work for dust collection in metals industries. Installation and service information is included.

350 STEAM GENERATORS, BOILERS

Wickes Boiler Co.—Three bulletins illustrate and describe the company's type-a water tube steam generators for shop assembly, and the company's dowtherm vaporizer. Photos, diagrams and specification tables are included.

351 FILTRATION EQUIPMENT

Croll-Reynolds Engineering Co., Inc.—Bulletin describes the company's method of filtration. Also included are specification data on sizes and capacities and a listing of the company's filtration facilities such as laboratory, pilot plant demonstrators and special engineering services.

352 PACKAGE BURNER UNIT

Iron Fireman Mfg. Co.—Folder No. 2827 describes modern automatic firing unit for high or low pressure boilers using gas, oil, or combination. Illustrations and cutaway views of burner units and typical installations to boilers are included.

353 LUBRICATION

Stewart-Warner Corp., Alemite Div.—A bulletin describes the company's centralized lubrication system for industrial machinery. The bulletin also describes and illustrates various fittings, and is supplemented with a series of data sheets showing cross sections of the company's lubrication fittings.

354 OSCILLOGRAPH, CATHODE-RAY

Allen B. Du Mont Labs., Inc., Technical Sales Dept.—Catalog gives description and specifications of a complete line of cathode-ray oscillographs, cathode-ray tubes and auxiliary equipment for use in all phases of production and labor work.

355 FLEXIBLE COUPLING

Ajax Flexible Coupling Co., Inc.—Bulletin 52 describes a new spline or gear-type coupling designed to handle more shaft misalignment than conventional flexible couplings. The bulletin includes dimension tables, engineering diagrams, service factors, and ordering specifications.

356 AIR-COOLED ENGINES

Wisconsin Motor Corp.—Bulletin S-164 includes condensed specifications covering the company's heavy-duty air-cooled engines and shows power and torque curve diagrams, dimension diagrams, construction specifications and illustrations of the engines' features.

357 GASKETS, METAL RASCHIG RINGS

Metallo Gasket Co.—Bulletin No. 53 describes metal and metal combined with soft packing for use on high and low pressure service, metal tower packing made as Raschig and Lessig rings. Also included are washers, shims, and metal asbestos valve disks.

358 SAFETY MARKING TOOLS

M. L. Cunningham Co.—Catalog No. 100, 28 pages, illustrates and describes more than 100 different marking tools and devices. Also included is information on Mecco safety steel, a specially-developed alloy which is said to reduce spalling and mushrooming, and to increase marking life.

359 STEEL TUBING

Higbie Mfg. Co., Avon Tube Div.—A 12-page bulletin illustrates and describes the company's steel tubing. Application data and specifications are included. Among the applications listed are automotive tubing, heating elements, condenser coils, space heater tubes, gasoline and diesel engine tubes, gas stove pilot tubes and supply lines, toys, hardware, radio, tv antennae.

YOUR *New Catalogs* GUIDE

360 ROLLER BEARINGS

Rollway Bearing Co., Inc.—Catalog TR-854-DC lists Tru-Rol bearings from 17 mm to 200 mm bore. The line has been expanded to eleven different types of bearings which feature crowned rollers. Catalog features an alignment chart for accurate, simple, calculations.

361 FLOW SIGNAL TRANSMITTER

Hagan Corp.—The Hagan flow signal transmitter is described in a new bulletin, No. 2553. This pneumatically operated pressure-differential measuring unit transmits proportional signals to remote recording or indicating instruments, or to automatic control elements. The signals may be linear with flow or linear with pressure differential. Diagrams in the bulletin illustrate seven suggested uses of the transmitter in measurement of flow, liquid fuel, liquid level, and absolute pressure. Flow applications include measurement of steam output from a boiler, superheater or evaporator; of feedwater flow to a boiler; of liquid flow through pumps of gas, vapor, or liquid flow in process systems.

362 INDUSTRIAL CASTERS

Faultless Caster Corp.—An 80-page catalog gives information on the company's line of casters for industrial applications. Included are light, medium and heavy duty, and miscellaneous casters. Products are diagrammed and illustrated. Specifications and dimensional data is in table form, and suggested application information is included.

363 METAL FASTENERS

Standard Pressed Steel Co.—Catalog pictures and describes the Unbrako line of precision socket screw products and points up the savings in time and money in using standards instead of specials. Also included are pressure plugs and dowel pins.

364 SPIRAL CONVEYOR

Jeffrey Mfg. Co.—Catalog No. 851 lists the six principal types of the company's spiral conveyors along with necessary fittings. It includes a table on the classes of material which can be effectively handled by this system.

365 DRAFT GAGES, GAS ANALYZERS

Ellison Draft Gage Co., Inc.—Bulletin 354 reviews the company's entire line of draft gages, saturator gages, air filter gages, pitot tubes, steam calorimeters and gas analyzers, and sets forth the company's service policy.

366 CONTROL VALVES

Conoflow Corp.—A 12-page bulletin describes the company's "LB series" control valves said to feature a single-seated, split-body with renewable seat ring and an improved version of the cylinder conomotor power operator. Positioning accuracy said to be better than one part in 1000 of instrument output span.

367 BOILERS

Erie City Iron Wks.—Bulletin deals with engineering design of steam generators. Describes in detail with line drawings, various types, pointing up features and advantages. Tabular data on capacities and dimensions. Also describes waste heat boilers, auxiliary equipment, water walls, superheaters, economizers, preheaters, grates, stokers.

368 AIR FILTERS

American Air Filter Co.—Bulletin No. 248 describes the company's automatic air filter with a renewable media filtering curtain of bonded glass fiber material supplied in rolled form. Included are application photographs, a dimensional diagram and capacity tables.

369 BOILER WATER SAMPLE COOLER

Davis Engineering Corp.—A 4-page bulletin, No. 110, includes design specifications on the company's boiler water sample cooler No. 75. A set of charts is included to determine cooling-water flow rate for various sample temperatures. Typical piping hookups and instructions on the installation and operation of the cooler are included.

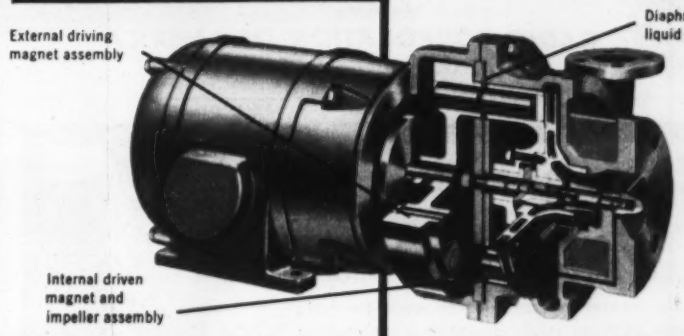
370 PRODUCT BULLETINS

B-I-F Industries—Bulletin 3-A lists the company's bulletins which are available on chemical proportioning equipment products for water and sewage applications, industrial applications; volumetric and gravimetric feeders for dry materials and liquids; instruments for metering and controlling flow, liquid level, temperature, pressure, weight.

What's NEW in pumps from PEERLESS PUMPS ?

HERE'S A *NEW* PUMP WITH A MAGNETIC DRIVE

WETTED END IS COMPLETELY ISOLATED AND SEALED


External driving magnet assembly
Diaphragm isolates liquid to wetted end
Internal driven magnet and impeller assembly

Processes requiring a closed system of liquid flow are typical points of use for this new Peerless magnetic drive pump. In it, the drive end and wetted end are completely separated from each other by means of a nonmagnetic diaphragm. The pump has no packing, no seals, no physical connection between pump and motor; and the pump is lubricated by the liquid being pumped.

Hazardous, toxic, odoriferous and extremely hot or cold liquids, as well as those with highly corrosive properties are readily handled by the all new Peerless magnetic drive pump.

The new pump is driven by a 1, 1½ or 2 hp motor at 1760 rpm. Only one pump size is now available: 1 x 2½ x 8 inches. Materials of construction can be specified to suit liquid being pumped. Maximum capacity is 150 gpm. Maximum head is 70 feet. Pump can also be furnished in the vertical design up to 10 hp at 3460 rpm

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371 PORTABLE, BENCH, FLOOR SCALES

Toledo Scale Co.—Three folders describe and illustrate the features of portable, bench and floor scales in the new series of the company's industrial scales. Also shown are optional features, including weight printing, counting and illuminated indicators.

372 HYDRAULIC EQUIPMENT

Racine Hydraulics & Machinery, Inc.—A 24-page catalog, P-10-E, gives construction details, and dimensions of the company's line of pumps, valves, boosters and pumping units. The catalog is illustrated with cutaway drawings and diagrams and includes installation and performance data.

373 GAGES

American Machine & Metals, Inc., U. S. Gauge Div.—Catalog 64 provides 68 pages of illustrated information describing air-volume controls for pump installations, vapor-tension thermometers, d-c ammeters and voltmeters, water flow meters and gages of all types. Engineering information is included.

374 ALUMINUM HEAT EXCHANGER TUBES

Aluminum Co. of America—Illustrated catalog contains relevant data on Alcoa aluminum heat exchanger tubes. Covers advantages, fabrication, application in petroleum and petrochemical industries, chemical, steam, atmospheric, air and gas. Also use of aluminum alloys, fluid flow characteristics, heat transfer characteristics, specifications and data with tables.

375 MAGNETIC SEPARATION

Dings Magnetic Separator Co.—A catalog describes and illustrates the applications of magnetic separation to remove iron from materials carried on conveyor belts, in chutes, ducts, and from wet materials. A bulletin describes the company's magnetic clutch couplings.

376 FURNACE PARTS

Bernitz Furnace Appliance Co.—A brochure presents advantages of the company's air-cooled piers and sills. They are illustrated in use with Hoffman traveling grate and Detroit roto grate stokers.

377 LUBRICATION

Shell Oil Co.—A 40-page booklet, entitled "Fundamentals of Lubricating Greases," delves into chemistry of greases, and simplifies understanding through analogies and illustrations. A chart to help in selecting the right type of grease for specific applications is also included.

378 HYDRAULIC MAN-LIFT

Tey Mfg. Co.—A 6-page folder and a series of application photographs illustrates and describes the company's hydraulically operated articulated boom to which is attached either one or two crow's nests with controls that enable workmen to reach any point in space, within the upper half of a sphere whose radius is 26 ft from the top of its mooring. The unit reaches a full working height of 40 ft when mounted on any standard commercial truck chassis of $1\frac{1}{2}$ tons or more.

379 BLACK-ON-WHITE PRINTS

Charles Bruning Co.—"Copyflex Machines and Materials," a 26-page illustrated booklet explains the cost and time-saving advantages of the diazo-type direct reproduction process of making black-on-white prints of engineering drawings, as well as faster and cheaper copying procedures for one-writing business systems, such as production control and purchase order receiving. Specifications of Copyflex machines are also given.

380 LAYOUT MACHINE

Universal Drafting Machine Corp.—A bulletin describes and illustrates the company's new drafting and layout machine for personal use in office, home or hotel room. The machine, scales and folding board fit in a desk drawer or are portable in carton or case.

381 COUNTERS

Veeder-Root, Inc.—Condensed catalog covers Veeder-Root mechanical and magnetic counters, illustrating different styles and capacities available. A price list is included.

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

382 WORM GEAR MOTORS

D. O. James Gear Mfg. Co.—Catalog 46-C covers worm gear motors for horizontal and vertical drive. Ratios range from 5.66:1 to 100:1, from 1/3 to 30 hp. Rating tables, dimensions and prices are included. Supplement to catalog 47-C covers gear motor reducers, horizontal or vertical drive, in 35 sizes, 10:1 to 1200:1, from 1/4 to 75 hp.

383 FANS, BLOWERS

Chelsea Fan & Blower Co.—Catalog No. 600 and related bulletins give dimensional, performance and specification data on power line fans for industry, mines, foundries, duct-booster fans, ventilating fans, penthouse units, attic fans, window fans, wall louvres and octopus blowers.

384 PACKAGE WATER CONDITIONER

Permutit Co.—Bulletin 3869, 8 pages, describes the company's package water conditioning plant as a versatile, self-contained unit, designed to coagulate, clarify, neutralize, de-alkalize, and soften raw water supplies. Listed are component parts, principles of operation, ratings, capacities, and sizes of eight different models.

385 OIL, GAS BURNERS

Petro—Catalog 3048 gives 20 pages of information on the selection of equipment, engineering and manufacturing factors, design and construction features, types of controls, and types and ratings of Petro packaged units for oil, gas and combination oil-gas burners.

386 SOLENOID VALVES

Skinner Chuck Co., Skinner Electric Valve Div.—Bulletin No. 532-RI describes Skinner's four-way V-9 solenoid valve series. General characteristics are given as well as specifications for three principal types. Flow charts are appended.

387 ROLLER BEARINGS

Chain Belt Co., Shafer Bearing Div.—A 56-page catalog illustrates and describes with performance and specification tables and diagrams the company's line of normal duty and standard heavy duty roller bearing units, adapter mounting heavy duty pillow blocks, single and double row radial-thrust roller bearings, made-to-order units and aircraft bearings. General design and engineering information on the units is also included.

388 TEFLON VALVE, PUMP PACKINGS

U. S. Gasket Co.—12-page catalog describes "Chemiseal" V-type, wedge-type and cup-and-cone type packing made of Teflon, for manual, air or motor-operated valves. Also listed are three types of pump packing for sealing against all types of corrosive materials.

389 ENGINE MANUFACTURE

Avco Mfg. Corp., Lycoming Div.—A 40-page brochure features highlights of the company's history, products, plants, research, engineering and services in the field of aircraft engines, turbines, industrial engines, tank engines, complete assemblies, hardened and ground precision parts, gears and machined parts, generator sets, heat treating and plating, steel fabrication, castings and boilers.

390 AIR-HARDENING TOOL STEEL

Firth Sterling, Inc.—Catalog section 20-010 describes Cromovan, an air-hardening high chrome-high carbon die steel recommended by the company for application in tools and dies requiring maximum production between grinds. The material is said to have excellent compressive strength and to respond uniformly to heat treatment with little size change.

391 STEAM GENERATING EQUIPMENT

Riley Stoker Corp.—A 4-page bulletin provides general information on Riley boiler units, fuel-burning equipment, and stokers. Typical complete installations, in addition to component units, are illustrated.

392 METAL BELLOWS

Flexonics Corp.—A 20-page bellows design guide, Catalog 140, describes the company's selection of bellows in wide selection of metals. The catalog covers bellows production, design consideration, guide to assembly, vapor pressure, temperature chart, and applications.

393 MATERIALS HANDLING EQUIPMENT

Allen-Sherman-Hoff Co.—Data sheets on hydraulic and pneumatic materials handling systems and components describe and illustrate application, design and construction, operation, dimensions (for components) and typical arrangements. Engineering charts and technical data are also included.

394 ALUMINUM SHIMS

Laminated Shim Co., Inc.—An 8-page bulletin contains engineering and design data and specifications on brass, steel and aluminum shims. Also available is a 4-page folder on shims and stamping to rigid specifications and a data sheet on the use of aluminum shims.

395 SILENT CHECK VALVE

Williams Gauge Co.—Folder describes flanged silent check valve in sizes from 1 to 10 in. in one type and from 12 to 20 in. in another. Drilling table for 125 lb American Standard semi-steel-bronze trimmed, also drilling table for 250 lb 1/16 in. raised face. Illustrated uses.

396 COPPER

Copper & Brass Research Assn.—"Copper—Today and Tomorrow" is a 4-page booklet on the position of copper in the U. S. economy. Future needs, sources, the importance of scrap, reserves, and the future outlook for copper are covered.

397 ELECTRIC MOTORS

American Electronics, Inc., American Electric Motors Div.—A loose-leaf catalog contains dimensional, specification and performance data on the company's motor driven blowers and fans, a-c industrial motors, fixed or variable frequency drive motors, rotary high frequency power supplies.

398 EXPANSION JOINTS

Zallea Bros.—Bulletin 351 describes the company's packless expansion joints and flexible connectors, their application, construction details and design features. The bulletin treats joints and connectors with flanged or welding connections, for traverses from a fraction of 1 in. to 7 1/2 in., in diam up to 72 in., for pressures from vacuum to 2000 psi, and for temperatures from sub-zero to 1600 F.

399 PRESSURE SEALS

Sealol Corp.—Bulletin No. 7 describes Sealol, a balanced pressure seal. The 8-page booklet includes descriptions of types of seals, along with installation and design data and typical installations.

400 OIL AND GAS FIRED BOILERS

S. T. Johnson Co., Mears, Kane, Ofeldt, Inc. Div.—Bulletins 2-K, 6-G, 7-D and 4-G cover line of gas, oil and combination oil and gas fired boilers from 1 to 30 hp, with the necessary automatic boiler feeds.

401 AIR, HYDRAULIC CYLINDERS

Hanna Engineering Wks.—Catalogs 233A, 236 and 750 describe the company's fluid power cylinders; 233A, operating pressure to 2000 psi; 236, operating pressure to 250 psi; and 750, operating pressure to 750 psi. Catalog 254 describes cylinder operating valves, cylinders suitable for material movement and handling, machine control and actuation.

402 SPHERICAL ROLLER BEARINGS

S K F Industries—Bulletin 365 discusses in detail the company's improved (Type C) spherical roller bearing said to increase capacity 25 to 50 per cent and service life 2 to 3 1/2 times. A tabulation of capacity comparisons, and life comparisons between the original spherical design and the Type C is also given.

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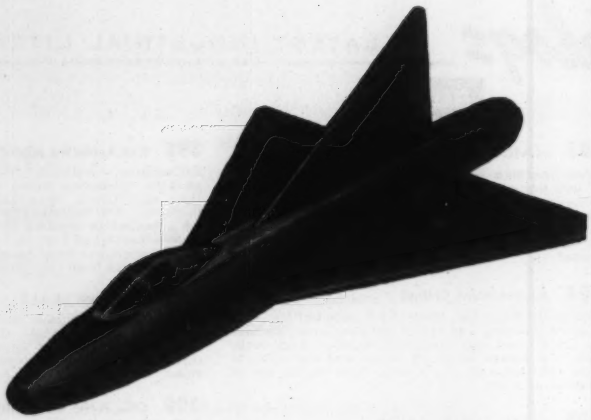

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403 RIVET SELECTION

Milford Rivet & Machine Co.—A slide-card rivet selector gives complete dimensional information on extruded, drilled, bifurcated, and male and female cutlery rivets. It also contains the clinch allowance and clearance hole size of rivets.

404 HYDRAULIC VANE PUMP

Denison Engineering Co.—Bulletin P-5 fully describes new Pump/Motor, which is usable as either pump or motor without alterations of any kind. Designed for use up to 2000 psi, the Pump/Motor is completely radially balanced. Interchangeable cam rings offer eleven different pumping capacities from 3 to 82 gpm, plus motor torque ratings from 13 to 257 in.-lb per 100 psi.

405 INSULATION

Ehret Magnesia Mfg. Co.—Bulletin describes full line of insulation products including 85 per cent magnesia insulation for temperatures up to 600 F; insulation for temperatures up to 1500 F; high temperature blocks for temperatures up to 1900 F. Other insulation products described include sponge felt, air cell, wool felt, anti-sweat, frostproof. Charts and technical data are also included.

406 POWER, PROCESSING EQUIPMENT

Schutte & Koerting Co.—Bulletin SK-1 describes the company's line of products, including jets of all types and materials, valves, strainers, heat transfer apparatus, oil burning equipment, gear pumps, instruments for indicating, controlling, recording the flow of all fluids, and many other products. Products listing is supplemented with available descriptive literature references.

407 AIR GAGES

Taft-Peirce Co.—Catalog No. 613 covers the company's comparator units and illustrates many inspection problems solved by air gaging. Also included are specifications and size ranges of the company's standard air ring and air snap gage members.

408 STEAM TRAP PROBLEMS

V. D. Anderson Co.—Bulletin No. 151 entitled "Solving Steam Trap Problems," contains 36 pages of illustrations, drawings, and charts, describing the importance of trap selection and showing application for various industries.

409 HYDRAULIC DYNAMOMETERS

Taylor Dynamometer & Machine Co.—Bulletin No. 761 describes the construction and operation features of the company's hydraulic dynamometers. A brief summary of the range of models and capacities is included, starting with fractional horsepower units to 6000 hp.

410 FORCED, INDUCED DRAFT FANS

Green Fuel Economizer Co., Fan Div.—The company offers three bulletins: (1) covering mechanical forced draft and induced draft fans; (2) diffuser fans; (3) the company's Economizers.

411 REFRACTORIES

Norton Co.—A 32-page manual deals with the application and suggested uses of "Crystdon" silicon carbide refractories in walls of boilers. Also included are curves of the thermal conductivity and thermal expansion of various refractories and air flow through air-cooled blocks.

412 DUST AND FUME COLLECTORS

Northern Blower Co.—Catalog 1002-6 describes exhaust fans for dust collecting and air handling and includes complete performance tables, test curves, etc. Plans and elevations of typical dust-collecting installations are shown. Separate additional bulletins contain descriptions, dimensions, capacities, etc. of Norblo bag type, hydraulic type, and centrifugal dust collectors.

413 MERCURY SWITCHES

Minneapolis-Honeywell Regulator Co., Micro Switch Div.—A 12-page catalog, No. 90a, pictures and describes standard designs of the company's mercury switches for use in a-c or d-c industrial and commercial switching applications that provide low force and tilt motion. The switches are classified as protected, heavy duty, general use, small and sensitive mercury switches. Information includes dimensions, description, electrical rating, operating angle, lead wires and application data.

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New Catalogs GUIDE

414 CONSTANT FORCE SPRINGS

Hunter Spring Co.—A booklet outlines design and application data on the company's Neg'ator, a constant force spring device said to be capable of exhibiting a negative, or near negative, force deflection characteristics. These deflection characteristics are treated in detail together with many current applications. Applications include the use of the unit or a spring (extension), torque transmitter, clamp, transducer, motor and many others.

415 LOW-TEMPERATURE EQUIPMENT

Arthur D. Little, Inc., Mechanical Div.—A 24-page catalog gives information about the company's services and the following products: helium and hydrogen liquefiers, oxygen plants, helium refrigerators, liquid oxygen pumps, liquefied-gas storage containers, air coolers, research electromagnets.

416 HOSE FITTINGS

Parker Appliance Co.—Catalog 4400 provides full description of Hoze-lok fittings and hydraulic hose assemblies for medium pressure cotton covered single wire braid hose, medium pressure rubber covered single wire braid hose, and high pressure rubber covered double wire braid hose.

417 SUPERCHARGERS

Dexter Folder Co., Miehle-Dexter Supercharger Div.—Bulletin No. 153 describes the company's superchargers for internal combustion engines and blower and air compressor operations. Bulletin contains selection graphs showing various model performances in terms of cfm vs. rpm and cfm vs. hp.

418 SUMP PUMPS

American-Marsh Pumps, Inc.—Comprehensive eight-page bulletin 325-A for engineers, architects and contractors who specify sewage and sump pumps. Describes three types of pumps: NKS Vertical Wet Pit Single or Duplex; NKV Vertical Dry Pit; and NKH Horizontal. Complete specifications given for all types and optional equipment is illustrated and explained.

419 PANTOGRAPH ENGRAVER

Green Instrument Co.—A brochure describes the company's 2-dimensional pantograph engraver said to offer an infinite number of reduction ratios from 2 to 1 to infinity. Single hand wheel adjusts both master copy table and cutting tool in thousandths of an inch. Throat depth permits engraving up to 15 in. from outer edge of panel of any size.

420 PLANT CONSTRUCTION

Dravo Corp., Machinery Div.—A 45-page book describes the services and activities offered by the company. The book shows examples of construction projects completed for steel mills, public works, gas and oil pumping stations, industrial facilities, and pipe fabrication and erection.

421 BELT CONVEYOR IDLERS

Chain Belt Co.—A 42-page catalog covers with illustrations, diagrams and tables of specifications and dimensions, the company's line of belt conveyor idlers and machinery. General design, engineering and selection information is included.

422 WEAR PREVENTIVE ALLOYS

Coast Metals, Inc.—Literature describes the company's wear preventive alloys designed to combat heat, corrosion, erosion, impact and abrasion. Alloys are supplied in the forms of hardsurfacing weld rods, wire for automatic welding, powders and certain types of castings.

423 CELLULAR GLASS INSULATION

Pittsburgh Corning Corp.—Application and product information on Foamglas, a rigid cellular glass insulation for walls, ceilings and floors is outlined in a 24-page illustrated booklet. Also included are details on how to finish the material, a table of insulation values of typical constructions using the material, and graphs on the effect of moisture and heat transmission on it. Also available, a 4-page bulletin on this material as pipe insulation.

424 OPTICAL TOOLING INSTRUMENTS

Charles Bruning Co.—Illustrated bulletin, No. A-2154, explains how two new optical tooling instruments, a jig transit and an optical transit square, can be used to establish and maintain a vertical plane for setting points accurately in assembly work, gage wear in tools and dies, and reduce errors to less than .001 in. in general aligning applications.

Chain

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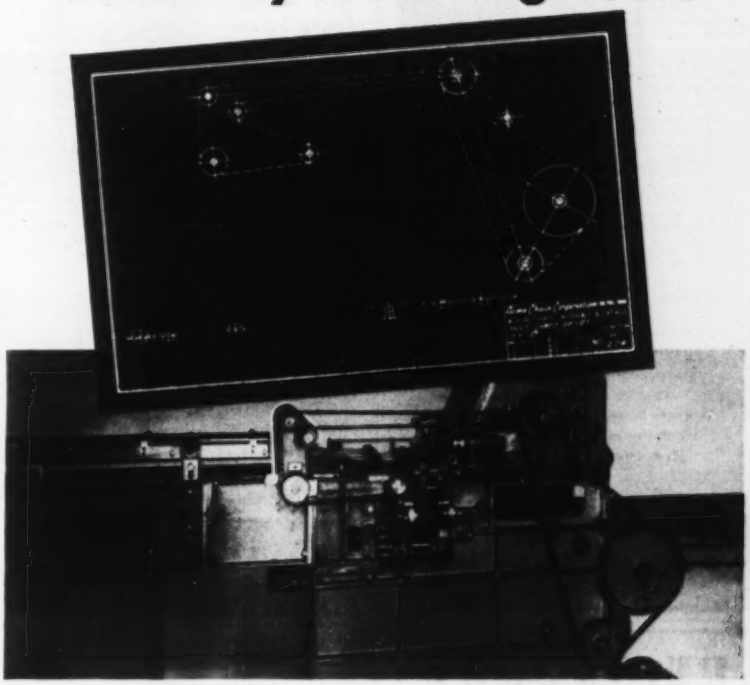

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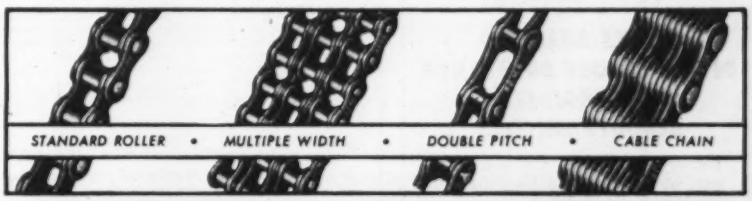

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LATEST INDUSTRIAL LITERATURE

425 PNEUMATIC AIR TOOLS

Chicago Pneumatic Tool Co.—A 148-page catalog presents the company's complete line of air powered tools for the mechanical industries. Included are impact wrenches, screwdrivers and nutrunners, drills, abrasive tools, riveters, hammers, hoists, balancers, air motors, air line accessories, special railway equipment.

426 AIR-OPERATED CHUCKS AND CYLINDERS

Cushman Chuck Co.—Catalog PO-64-1953 gives complete engineering data and prices on steel and aluminum body chucks and air cylinders designed to operate without chatter at high speeds to provide low-cost, time-saving tooling on repetitive operations. It also includes reference chart, installation instructions, and schematic diagrams.

427 ELECTRIC MOTORS

Jack & Heintz, Inc.—An 8-page booklet describes the company's facilities for designing, testing and producing special electric motors up to and including 2 hp. Included are photographs showing the various features of the motors.

428 INDUSTRIAL EQUIPMENT

R. C. Mahon Co.—A booklet displays the units of plant and production equipment produced by the company for virtually every industry, and outlines the company's ability to design, engineer and produce special equipment and machines tailor made to fill the requirements of job and process mechanization in modern production plants. Examples are shown.

429 FLOWMETER

Devicengineering Co.—Bulletin No. 1-100 describes the company's new flowmeter for continuous and accurate measurement of quantity rates of corrosive and non-corrosive liquid and gas. Unit available for installation in pipe lines from $^1/_2$ to 12 in., to cover flow rates from 0.2 to 2000 gpm of liquid, 10 to 60,000 lb per hr of steam, 1 to 6000 cfm of gas.

430 PLUG NUTS

Lamson & Sessions Co.—Leaflet, illustrated, briefly lists advantages of plug nuts and how they work. They are hardened round nuts which are pressed into a punched or drilled hole of pre-determined diameter in ferrous or non-ferrous material. In any thickness of material down to .030 in. and in any tap size from No. 4 to $^1/_2$ in.

431 PERMANENT MAGNETS

General Electric Co., Carboloy Dept.—Technical report PM-111 describes Carboloy permanent magnets, sintered grade 5, gives design information, tolerances, engineering service, applications, magnetic properties, physical properties. Technical report PM-112 describes cast grade with comparative information as on sintered grade 5. Illustrated with tables.

432 HIGH TEMPERATURE HEAT TRANSFER

International Boiler Works Co.—A 6-page folder illustrates and diagrams the company's Dowtherm vapor generator designed and constructed on the principle of forced recirculation for high temperature heat transfer. The unit is said to provide continuous operation at temperatures from 500 to 750 F, for use in food processing, heavy chemical, paint varnish, resins, turpentine, plastics, coatings, coal tar products, petroleum, and natural gas industries.

433 EXPANSION JOINTS

Badger Mfg. Co.—A general catalog gives full details of the company's standard corrugated type expansion joint (both directed-flexing, self-equalizing and non-equalizing) and special types such as hinged, tandem and balanced joints for special pipe line movements. Included is a detailed discussion on how to select an expansion joint for any given set of pipe line conditions.

434 OVERHEAD MATERIALS HANDLING

Cleveland Crane & Engineering Co., Tramrail Div.—A 12-page, 2-color booklet gives engineering and application data on rails, arch beams, carriers for hand and electric operation, motor tractors, switches, cranes and transfer cranes, gantry cranes, buckets and grabs.

435 PILLOW BLOCKS

W. A. Jones Foundry & Machine Co.—Catalog 500 contains complete selection and application information on the company's heavy-duty pillow blocks, Timken roller bearing equipped, for shafts $1^{15}/_{16}$ to 9 in. in diam. Cutaway view and cross-section diagrams illustrate and describe design features including self-alignment and positive metal labyrinth bearing seals. Lubrication information and installation data are also included.

436 STEAM, AIR, GASOLINE TRAPS

W. H. Nicholson & Co.—Catalog 953 is a 32-page standard reference on drainage methods, describing traps for all mediums and pressures. Included are thermostatic and metal expansion for medium pressures and weight and piston-operated for heavy duty. Installation diagrams and data for determining proper size of trap are included.

437 ALUMINUM

Revere Copper & Brass, Inc.—"Revere Aluminum," 12 pages, discusses the advantages of aluminum alloys, the variety of extruded products available, the uses to which seamless drawn tube and pipe can be put, and the uses of sheet, bus bar, and die-pressed forgings. A 2-page table contains properties of Revere aluminum alloys, giving both new and old designations.

438 INSTRUMENTS

Consolidated Engineering Corp.—A 12-page general catalog describes data processing instruments and systems for automatic measurement and recording of physical variables, such as pressure, vibration, acceleration, stress, strain and temperature. Systems are designed to record up to 50 high-speed physical variables simultaneously. All instruments are described briefly and specific technical bulletins are listed on each.

439 STEAM TRAPS, SPECIALTIES

Strong, Carlisle & Hammond Co.—Catalog 68 Supplement describes and illustrates the company's series 40 traps, designed to operate on low loads as well as at full capacity. The entire operating mechanism is of stainless steel. Semi-steel trap is described as suitable for maximum steam pressure of 250 psi. Traps of cast and forged steel will be available for pressures up to 2500 psi.

440 VERTICAL SHAFT PUMPS

Nagle Pumps, Inc.—Form CW-OC describes the company's vertical shaft pump said to feature simplicity of design, ease of installation, no submerged bearings and wide range of settings, sizes and capacities. The unit, designed for handling abrasive or corrosive liquids, heavily laden liquids or hot liquids, available with wide choice of materials.

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441 GEARS, SPECIAL MACHINERY

Earle Gear & Machine Co.—Catalog entitled "Earle Gears" describes and illustrates many types of gears and special machinery. It includes ordering information and technical data on spur gears and pinions, bevel gears, herringbone gears, worm gears and many other types of gears in all practical materials in diameters from 1/2 in. up to 34 ft. Also treated are racks, sheaves, sprockets and special machinery.

442 HEXAGON SOCKET SCREWS

Allen Mfg. Co.—General Catalog G-54, 48 pages, lists specifications for Allen's hexagon socket set screws, cap screws, flat head cap screws, pipe plugs, and shoulder screws, and dowel pins; hexagon keys, and internal wrenching nuts. Formulas, definitions, and a comparison of fits are included.

443 PRESSURE AND MECHANICAL TUBING

Copperweld Steel Co., Ohio Seamless Tube Div.—An 8-page folder describes and illustrates typical usages of seamless or welded pressure and mechanical tubing. It includes dimension tables and examples of the special fabrications and finishes possible.

444 MACHINING, FORGING

Kropp Forge Co.—One booklet describes the company's facilities for engineering, fabricating and finishing metal products. Another booklet shows the company's facilities for making forgings. Both are illustrated with photographs.

445 TURBO PUMPS

J. S. Coffin, Jr., Co.—Each component of the company's type DE turbo pump is pictured and its design advantages explained in a 6-page folder. The lubrication system is also described in detail. Typical uses are listed. Accessibility for repairs, parts and service, ratings, and what data to give for an estimate are included. Also available is 4-page illustrated "S" Bulletin describing in detail the company's type "CG" pump.

446 PRODUCTION CONTROL

Remington Rand, Inc.—"Production Control Systems and Procedures" is a 60-page booklet on production control and use of Remington Rand systems and equipment. A glossary of terms commonly used in production control procedures is included.

447 MERCURY CLUTCH

Automatic Steel Products Inc., Mercury Clutch Div.—An 8-page pamphlet describes the operation of the mercury clutch and its advantages over conventional clutches. A special table and photographs illustrate the many specific applications of this automatic torque control for gasoline engines and electric motors, said to eliminate many prevailing power transmission problems. The clutch is available in two series: series G for gasoline engines from 1/4 to 25 hp; series E for electric engines from 1/4 hp, 1800 rpm to 25 hp, 1800 rpm.

448 THERMOSTATIC BIMETAL

W. M. Chace Co.—A 36-page illustrated booklet describes and explains twenty-two uses of the company's thermostatic bimetal as regulating, controlling or actuating elements in temperature responsive devices. Included are ten pages of engineering data for element design and selection.

449 HYDRAULIC PRESSES, EQUIPMENT

R. D. Wood Co.—Brochure contains photos, description and specifications of the company's typical hydraulic presses. It also pictures and describes high pressure hydraulic valves, accumulators and hydraulic shock alleviators. Text covers markets in which these products are used, with emphasis on metal working, woodworking, rubber and plastic industries.

450 SURFACE PYROMETER

Cambridge Instrument Co., Inc.—Bulletin 194SA describes three surface pyrometers for temperature determination: roll, for still or moving rolls; needle, for insertion into materials in a plastic or semi-plastic state for within-the-mass temperature determination; and mold, for checking surface temperature of mold cavities and surfaces of almost any contour.

451 PRODUCT MANUFACTURE

Airtex Products, Inc.—A 2-color brochure describes the company's facilities for the design, manufacture, packaging and shipping of machined, punch-pressed

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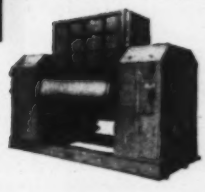

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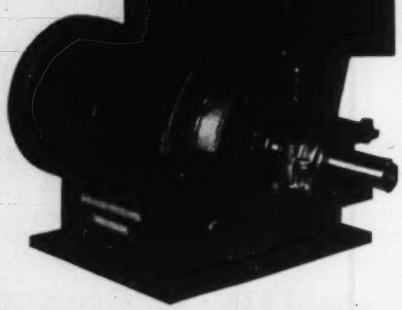

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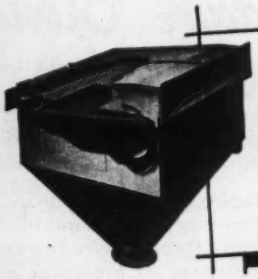

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and die cast products such as tie rod ends, water pumps, fuel pumps, shells, shell fuses, clutch release bearings, hydraulic brake cylinders and aircraft parts.

452 INDUSTRIAL INSULATIONS

Johns-Manville—A 40-page catalog, Brochure IP-6A, with descriptions, uses, and sizes of the principal products in the J-M industrial line. It illustrates and describes various types of J-M industrial insulations, and also serves as a reference catalog for information on J-M asbestos-cement pipes, friction materials, electrical materials, packings, flooring, and roofing.

453 SPHERICAL BEARINGS

Heim Co.—A 4-page folder describes the company's spherical bearings and rod ends for transmitting motion at varying angles. Cutaway and exploded photographs and diagrams are included, along with application data on the use of the equipment in various industries.

454 MAGNETIC TAPE RECORDING

Ampex Corp.—A 16-page, 2-color booklet illustrates and describes the company's magnetic tape recording equipment and offers suggested applications in the fields of geophysical exploration, wave analysis, computing devices, study of sounds, medical teaching and research, facsimile recording, and uniform re-creation of phenomena.

455 SPREADER STOKER

Detroit Stoker Co.—A 16-page catalog describes the company's type C-C continuous ash discharge spreader stoker designed for firing all types and makes of modern boilers from approximately 5000 to 75,000 lb per hr steam capacity. Photographs diagrams of typical installations are included.

456 THERMOPLASTIC PIPE AND FITTINGS

United States Rubber Co.—Bulletin describes "Uscolite," a rigid, tough, lightweight, corrosion-resistant thermoplastic pipe. Chemical properties, uses, resistance given. Threading and machining, bending, dimensions, installation, valves with tables and diagrams of fittings.

457 SOLIDS PUMPS

Western Machinery Co.—Bulletin SP-10 illustrates and describes the company's solids pump for handling such materials as fruits, foods, ores, coal, sewage, chemicals, rags and textiles. A diagram shows the design features and a cutaway photograph is used to illustrate the working principle of the unit.

458 BLOWERS

Read Standard Corp.—A 12-page catalog illustrates and describes the company's Standardaire axial flow positive displacement blowers. Dimensions and capacities of various models are tabulated and diagrams illustrate design features. Also included is product information on the company's materials handling equipment and mixers for the chemical processing industry.

459 STEEL AND ALLOY PLATE FABRICATION

Downingtown Iron Works—Bulletin PF, 12 pages, shows typical pressure vessels, tanks, etc, and fabrications of carbon, stainless, clad, and other ferrous and nonferrous metals and alloys. Towers, columns, converters, evaporators, separators, and heaters are illustrated with dimensions.

460 TIMING MOTORS

General Electric Co., Telechron Dept.—Bulletin IS-140 describes the advantages of Telechron synchronous timing motors and lists specifications of different models. Telechron instrument movements are included. Typical applications are illustrated.

461 SEWAGE DISPOSAL

Worthington Corp.—A 28-page engineering manual, W-318-B17, describes the design, operation and application of the company's comminutor, a device to cut solids in raw sewage to prevent damaging and clogging of handling equipment.

462 STAMPED GEARS

Winzeler Mfg. & Tool Co.—A 4-page illustrated bulletin describes stamped gears: spur, crown, pinion, spur and pinion clusters, laminated and special types. Gear data and tables are included. Also available is a 4-page stock gear die list including 16–80 diametral pitch spurs, 14½ and 20 deg pressure angle; crown gears, 24–64 diametral pitch.

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463 TIMERS

R. W. Cramer Co.—A 4-page bulletin covers Cramer's line of interval timers, reset timers, duplex-cycle timers, time-delay controllers, cycle timers, percentage timers, running-time meters, reversing motor timers, multi-contact timers, and time totalizers. Features of the synchronous motor used are emphasized.

464 PLASTICS

E. I. du Pont de Nemours & Co.—A 16-page booklet discusses the properties and applications of du Pont's Zytel (nylon resin), Teflon (tetrafluoroethylene resin), Alathon (polyethylene resin), and Lucite (acrylic resin). Included are a chart of comparative characteristics and a table of mechanical, thermal, electrical, optical, and miscellaneous properties.

465 CHEMICAL PUMPS

Roy E. Roth Co.—Section 100 covers Roth chemical pumps, 21 and 22 series, all single-stage, side-suction, end-mounted pumps based on turbine vaned-impeller design and built especially for chemical service. Advantages, applications, construction, and performance are included.

466 ELECTRONIC COMPONENTS

Texas Instruments, Inc.—Bulletin No. DL-S 426 covers silicon transistors and silicon diodes. Bulletin No. DL-C 424 covers subminiature transformers. Tables of specifications are in both bulletins, and two pages of performance characteristics curves are given for the transformers.

467 CONSTANT AREA DIAPHRAGM

Bellofram Corp.—A new long-stroke, deep-convolution, constant area diaphragm is described in B. F. 100 catalog, 12 pages, illustrated with photographs and typical application diagrams. It shows type of application data and installation diagrams to be provided when ordering.

468 CLAD STEELS AND STEEL SHAPES

Lukens Steel Co.—Three booklets cover "Flame Cutting Lukens Clad Steels" (10 pages), "Welding Lukens Clad Steels" (24 pages), and "Steel Plate Shapes" (16 pages). The first two contain instructions for performing the operations; the last illustrates the different sizes and shapes possible with steel plate.

469 AUTOMATIC ENGINE CONTROLS

Synchro-Start Products, Inc.—No. 5 Catalog contains engineering information on their entire line of products. It includes dimensional drawings, photographic illustrations, hook-up diagrams and maintenance tips on Synchro-Start full-automatic engine controls, alarm sets, governors, solenoids, relays, oil and water temperature switches, etc.

470 STEEL ALLOY EXTRUSIONS

Allegheny Ludlum Steel Corp.—A 4-page folder describes the company's hot extruded shapes offered in stainless tool steels, high temperature alloys and other steels. The leaflet describes the extruded shapes as being closer to finish sizes then regular hot rolled materials.

471 FLOW REGULATOR

Waterman Engineering Co.—Bulletin describes the company's new constant flow regulator with an automatic by-pass feature for power steering systems, fluid motors, or any hydraulic system where constant flow is required in the presence of varying pump output.

472 COMBUSTION EQUIPMENT

Hauck Mfg. Co.—The Catalog 52 gives a condensed and pictorial review of oil and gas combustion equipment for production, construction, and maintenance applications in industry. The catalog has 12 pages and 80 illustrations, arranged for readers' convenience.

473 PROGRESSING-CAVITY PUMP

Robbins & Myers, Inc., Pump Div.—Bulletin 30-C describes the Moyno Progressing-Cavity Pump. A helical rotor turning within a double-helical stator provides a gentle, positive displacement that will not break up semi-solids or aerate liquids. The pump is self-priming and will not vapor-lock or cavitate. No valves or pistons are used.

474 STEEL PROCESSING

Hydropress, Inc.—Brochure by G. A. Dornin, R. H. Spence and W. H. Meyer describes the Sound-Ingot Process where steel is melted by fully-killed steel practice and poured into big-end-up molds with very heavy taper, then stripped, sent to soaking pits and finally upset and forged.

475 VENTILATING FILTERS

Dollinger Corp.—12-page bulletin describes Stay-new automatic ventilating filters for large air volume and high efficiency. Bulletin 500 contains specifications, engineering and performance data in a wide range of sizes for handling any desired air volume. Two methods of automatic curtain cleaning are described and information for selection and installation is included.

476 REDUCTION EQUIPMENT

American Pulverizer Co.—Literature describes reduction problems of various processing industries. Construction and operating features, specifications are fully discussed and illustrated. Bulletins are available on coal crushers, stone crushers, metal turnings crushers, plastics granulators, wood hogs.

477 LEAD SCREW TAPPING

Automatic Methods, Inc.—New "Auto-tap" lead screw tapping heads, incorporating a lead screw reversing mechanism and positive depth control in a single compact unit which clamps to the quill of any drill press, are shown in Bulletin 601. Lead screw tapping attachments for converting drill press tapping set-ups are described in Bulletin 201. Advantages of lead screw tapping are discussed and several methods of fixturing on typical applications are described.

478 METAL TAGS

Jas. H. Matthews & Co.—A 4-page leaflet on Matthews metal tags for shipping, inventory, production control, and coding suggests specific tag applications for various industries. Hand-operated and press style tag embossing machines are also illustrated.

479 MACHINE TOOLS

Micromatic Hone Corp.—A 32-page illustrated catalog contains description of the Microhoning and Microflat process and equipment, specifications and work capacities of horizontal and vertical machines; representative range of tools, fixtures and abrasives; short explanation of automatic feeding and sizing features; availability of precision manufacturing and job Microhoning service facilities.

480 HYDRAULIC PUMPS

American Engineering Co.—Two bulletins on high pressure fluid power pumps. (1) Hydramite Bulletin No. 3 describes constant-displacement oil fluid power pump capable of delivering 3, 5, and 10 gallons per minute at pressures up to 5000 psi (2) Hele-Shaw Bulletin No. 2 describes variable stroke pump High Pressure, 2500-3000 psi capacities from 1 to 53 gpm: Low Pressure, 1000-1500 psi, capacities from 1 to 66 gpm and up.

481 STEAM GENERATORS

Preferred Utilities Mfg. Corp.—Bulletin 2000 contains a description of the principal design features of the four-pass Preferred Unit Steam Generator. A complete list of standard and accessory equipment plus a table of dimensions is also included.

482 BEVEL GEARS

Gleason Works—"Bevel Gear Manufacture. . .the Gleason System," by George Hessler, 16 pages, is offered as an explanation of the tools, and techniques used by Gleason for the production of bevel gears, including straight, zerol, spiral, and hypoid types. Diagrams and photographs, as well as extensive text, show these types of bevel gears and their manufacture.

483 CENTRIFUGAL FANS

New York Blower Co.—Bulletins describe complete new line of series of nyb centrifugal fans, both forward curve and non-overloading (IPL) types. Complete engineering data and capacity tables are included.

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FOUR New Catalogs GUIDE

484 REFRIGERATING MACHINES

Frick Co.—Bulletin No. 100-F describes the company's multi-cylinder compressors for use in air conditioning, marine service, water cooling, food storage and processing. Illustrations of the machines at work, diagrams of design details of various models, and dimensional and specification data are included.

485 STEEL FABRICATION

Nazareth Steel Fabricators, Inc.—A 6-page folder describes the company's facilities for turning out plate or light structural steel and illustrates various examples of its work. Data is given on the company's engineering service as well as its layout, shearing and cutting, forming and shaping and welding facilities.

486 ELECTRIC TIMING SYSTEM

Service Recorder Co.—Folder outlining accurate electrical timing devices for industry for recording operational and down time for cost control. Describes and illustrates Model M with features and operation. Can be applied to any type of industrial operation in single or multiple installation.

487 FURNACE CONSTRUCTION

M. H. Detrick Co.—A 50-page illustrated booklet, "Heat Enclosure Methods," outlines the development of furnaces and furnace construction. Suspended arch and wall constructions and their applications are shown for boilers, oil heaters, heating and melting furnaces, and other units. Engineering graphs and tables are presented to help select proper construction for any given conditions.

488 STEAM GENERATORS

Union Iron Wks.—Information on packaged water-tube steam generators which are furnished for oil or gas firing or both, is covered in Bulletin MH3-54. Cutaway illustrations showing construction features are included along with operation details. A photo-sequence story of the shop assembly construction is included.

489 DIE CASTING

American Zinc Institute—"Die Casting—Molten Metal to Finished Part" describes the advantages of die casting. Data on zinc, aluminum, and copper-base die casting alloys are given. Improved product design, lower costs, and excellent surface finish are claimed.

490 WOODRUFF KEYS

Standard Horse Nail Corp.—Pamphlet describes woodruff keys, made from cold drawn stock ASA. Illustration in line cuts of sizes. Also mention line of machine keys, taper pins, straight pins, cotter pins and special parts.

491 LUBRICATED PLUG VALVES

American Car & Foundry Co.—An 8-page booklet illustrates and describes the company's round port and rectangular port lubricated plug valves. Dimensions, specifications and capacities of various models are tabulated.

492 DUCT INSULATION

Pittsburgh Plate Glass Co., Fiber Glass Div.—A 4-page bulletin describing and giving the product specifications of the company's Superfine fiber glass features a section on the handling and application of the material. The material is composed of glass filaments ranging between .00003 and .0002 in. in diam, bonded into soft blankets of various densities and sizes.

493 BALANCING MACHINE

Taylor Dynamometer & Machine Co.—Bulletin No. 292 describes and illustrates manufacturing data and various applications of the company's universal static balancing machine. Block diagrams are included to show the operation and maintenance of the units.

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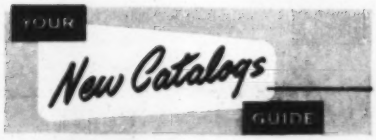

494 PORTABLE POWER SAW

Producers & Distributors—1-page, 2-color bulletin describes Key-Hak portable power saw which has 360 deg rotability and can be used as a keyhole saw, hacksaw, or scroll saw on steel plate, transite, pipe, corrugated metals. Also available is a folder on specifications of various power saw blades.

495 STEAM DROP HAMMERS

Erie Foundry Co.—Bulletin No. 335, 20 pages, illustrates and describes the company's steam hammer installations in industry. Also included are standard dimensions, material specification, comparative data on steam drop, mechanical press, board drop and counter-blow hammers and a section describing the company's facilities.

496 ELECTROLIZING

Electrolizing Corp.—A 20-page booklet describes and explains electrolizing and lists case histories of applications of this process. Also listed are products which, the booklet says, have been made to last longer as a result of the process.

497 SOLENOIDS

Soreng Products Corp.—4-page Bulletin CF-124 describes four basic models of solenoids with 12 sets of characteristics covering a broad range of applications. Contains detail drawings, power curves and other technical data.

498 CRANES

Chicago Tramrail Corp.—Bulletin TRC-101, 20 pages of illustrated descriptions of Trak-Rak storage systems which secure maximum storage space, require minimum aisle area with perfect maneuverability of loads. Trak-Rak cranes have eight basic motions, hoist up-down, bridge forward-reverse, trolley in-out, column rotation clockwise-counter clockwise. Auto body, bar stock, transformers, skid boxes, containers, tote pans, pipe and tube, sealing caps, and other handling and storage systems are shown.

499 STEAM TRAP

Sarco Co., Inc.—Bulletin 255-A describes the company's new type of steam trap which has only one moving part, a solid stainless steel disk. Valve head and seat are designed for 600 psi, 950 F, and the unit is said to withstand superheat, water-hammer, and corrosive condensate.

500 VALVE CONTROL

Barksdale Valves—A 34-page catalog covering manual, solenoid, and solenoid pilot controlled valves, pressure switches includes illustrations and specifications of valves, information on selection of pressure switches, operating data and flow patterns of various valves.

501 RECORDING SYSTEMS

Sanborn Co.—Oscillographic recording systems catalog describes one-, two- and four-channel recording systems for industrial research, design and production testing. Amplifiers listed for use in these systems or separately with other equipment include general purpose, strain gage, servo monitor. The catalog also contains data on the company's triplexer, threshold monitor, recorder assemblies, galvanometer, and a table of constants, price lists, and lists of users.

502 OIL HYDRAULIC CONTROLS

Commercial Shearing & Stamping Co.—20-page booklet on commercial fluid power controls contains performance data, capacities, types, details and mounting dimensions of oil hydraulic pumps, motors, valves and cylinders. Illustrations include photographs of typical installations, cutaway drawings and design sketches of controls needed for a complete heavy duty oil hydraulic circuit.

503 HYDRAULIC EQUIPMENT

Char-Lynn Co.—New catalog of hydraulic hp products describes the company's line of pumps, power pacs, cylinders, hose couplers, valves. The catalog includes data, specifications, dimensions, prices, and cutaway views. Information is given for sizing hydraulic systems meeting SAE and ASAE requirements.

504 COAL HANDLING

Hayward Co.—Bulletin describes and illustrates the company's Class E-15 coal and coke handling bucket. Complete capacity, weight, and dimensional data is given, and data is included on the company's lightweight power wheel clam shell designed to weigh a pound of bucket to a pound of coal handled.

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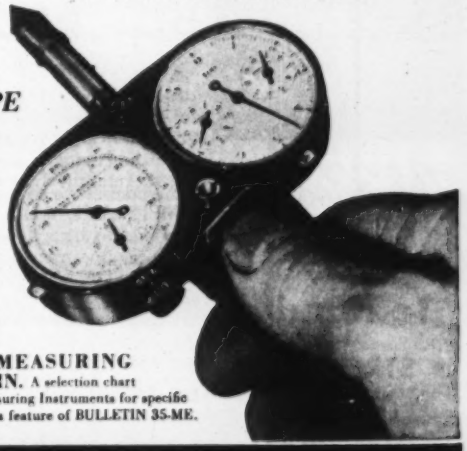

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Barco Flexible Strut Joints are an important aid in *modern* plant construction. A typical use is at the ends of struts for supporting or bracing large catalyst carrier lines or vent stacks on fluid catalytic crackers. In such cases, where horizontal lines require supports, two braces (with Barco Flexible Strut Joints in each) make costly "A" frames unnecessary. Other uses include the guying of tall vessels and columns and directing thermal movements of high temperature piping.

The Modern Way **to handle**

- **STRESS LOADS**
- **VIBRATION**
- **WIND SWAY**
- **THERMAL MOVEMENTS**

SIMPLE, VERSATILE!—The Barco Strut Joint is a dependable, compact, versatile fitting requiring practically no maintenance. It is a simple ball and socket that provides a point of flexibility in struts and guy rods. The close fit between the ball and the casing, allows for reversible loads, not possible with pin and clevis type braces. Barco Strut Joints support without restricting freedom of movement of piping.

COMPLETE LINE—Barco manufactures Strut Joints in the following sizes and load capacities: 1″—6,000 lbs., 1½″—8,000 lbs., 2″—12,000 lbs., 3″—20,000 lbs., 4″—50,000 lbs., 6″—130,000 lbs. Joints are made with welding ends for field or shop use. Unique "Bar-Moly" treatment of wearing parts provides a permanent dry lubrication for long service with little or no maintenance.

ENGINEERING SERVICE—Barco will be glad to work with you in the selection of joints to meet your requirements. *Specifications and information on request.* BARCO MANUFACTURING COMPANY, 521M Hough St., Barrington, Illinois.

BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING AND REVOLVING JOINTS FOR CONVEYING FLUIDS

505 FATIGUE TEST MACHINES

All American Tool & Mfg. Co.—Form 150 describes new heavy duty models of vibration fatigue test machines. One model produces vibration in simple harmonic motion, vertically, and another produces vibration horizontally. Both have a work load capacity of 150 lb and equipped with type "D" variable frequency control.

506 OIL PURIFICATION UNIT

De Laval Separator Co.—An 8-page folder illustrates oil purification equipment and contains details of operation, sectional views and various uses. Portable units designed especially for plants with a limited amount of oil are illustrated and various phases of centrifugal oil purification are pointed out.

507 STEEL CASTINGS

Lebanon Steel Foundry—A booklet outlines the company's facilities for making steel castings with step-by-step plant pictures. Also included are illustrations of the use of castings in industry. A pocket-sized, slide-card selection chart, showing the nominal analyses and minimum mechanical properties of various grades of carbon and low alloy steel castings is also available.

508 FLEXIBLE METAL HOSE

Atlantic Metal Hose Co., Inc.—Bulletin 15-D and Catalog No. 500 illustrate and describe the company's flexible metal hose for high pressure applications, diesel exhaust, conveyors, unloading and tar and asphalt. Dimension and specification data is given in tabular form.

509 INSTRUMENT BEARINGS

General Motors Corp., New Departure Div.—A 28-page booklet illustrates and describes the company's instrument bearings. Included is data on bearing requirements of synchros and other motors, dimensions, highlights of the company's instrument bearing manufacture, American Ordnance Assn. bearing classification, fundamentals for torque testing, specifications and typical instrument bearing applications.

510 AUTOMATIC CONTROL EQUIPMENT

Kieley & Mueller, Inc.—Catalog CV53 illustrates and describes the company's control valves for modern process requirements. In addition to cutaway photos of the firm's various diaphragm control valves, motors, seals and accessories, materials specifications and design features are given in graph form.

511 WORM GEAR JACK

Duff-Norton Mfg. Co.—An 8-page manual illustrates applications of the company's worm gear jack for raising and lowering movable parts in metalworking machinery. Included are the elevation of mill tables, rolls, conveyors, machine beds, molds and dies, furnace lids, loading platforms, loading racks, arbor presses, hinged mechanisms.

512 DRY ICE CONVERTERS

Dry Ice Converter Corp.—A 4-page bulletin describes the company's dry ice converters for use in power plants, aircraft, chemical and rubber plants, oil producing companies, atomic energy, paints, varnish and resin processing facilities.

513 AUTOMATIC CONTROLS

Mason-Neilan Regulator Co.—A 16-page catalog covers the company's equipment for automatic control, including pressure regulating valves, instruments, air-operated control valves and liquid level controllers. Construction, operation, rating and range information is given.

514 WELDING FITTINGS

Bonney Forge & Tool Wks.—A 32-page catalog illustrates and describes the company's 90-deg branch pipe welding fittings. Installation instructions, code data and engineering information is given. Sample problems are presented in graph form and case histories of applications are included.

515 LUBRICATION

Loewy Construction Co.—Brochure discusses the automatic lubrication systems developed for the Loewy 50,000- and 35,000-ton forging presses. Because of the size, design and operating features of these machines, the conventional methods of lubrication could not meet all specifications. The problems posed required a new approach and the resultant solutions are described after a brief outline of the press design and operation.

YOUR

New Catalogs GUIDE

LATEST INDUSTRIAL LITERATURE

516 ELECTRONIC PROCESS CONTROL

Manning, Maxwell & Moore, Inc.—A 28-page catalog describes and illustrates the company's equipment for electronic communication in process control. Major elements and design features are given and the following equipment is described; miniature recorder, recording control station, indicating control station, controller, manual positioner and valve positioner.

517 SHAFT MOUNTED DRIVES

Falk Corp.—Bulletin contains information, design data, selection tables, dimensions, weights, installation photographs, on standard gear drive which offers high ratios of speed reduction in limited space. Input speeds range from 420 to 10 rpm in the range between 1/2 and 30 hp.

518 BLADELESS SEWAGE AND TRASH-PUMP

Fairbanks, Morse & Co.—Bulletin 5400K-1 describes the new Fairbanks-Morse bladeless sewage and trash pump, utilizing a single-passage bladeless impeller. Cutaway views and descriptive text explain the details of construction of the pump, both horizontal- and vertical-shaft models. Dimensions, specifications, and characteristics are given.

519 VIBRATION ISOLATORS

Barry Corp.—Standard and special mounts for shock resistance, noise control in airborne, shipboard, and vehicular installations as well as industrial machines are described in 4-page catalog keyed to supply detailed information by reference numbers. Also offers service facilities of representatives for development, test and application of vibration control.

520 CONTROLLER

Powers Regulator Co.—Bulletin 308 describes a new, inexpensive, precision pneumatic temperature control available for operating diaphragm valves, damper motors, etc. Powers gradual acting Limitem is a differential expansion type control designed for regulating heating, cooling, ventilating, air conditioning, dew point control and industrial processes.

521 TECHNICAL BOOKS

The American Society of Mechanical Engineers—1955 Catalog of ASME Publications is a 20-page descriptive price list of current books, standards codes, research reports, and periodicals published by the Society.

522 FASTENERS

Standard Locknut & Lockwasher Inc.—Bulletin No. 31 describes patented fastener, the "X-Washer." Dimensional information, as well as application data, is included.

523 VIBRATING CONVEYORS

Carrier Conveyor Corp.—"Natural-Frequency" vibrating conveyor Bulletin No. 111, 12 pages, describes new application of scientific natural-frequency vibrating principle as applied to Carrier vibrating conveyors with great reduction in power requirements, double capacity, and significant savings in maintenance and down-time costs. Illustrates applications for detergent powder, crushed stone, foundry sand, castings and shake-out, spiral elevating for air cooling and other drying, heating, separating and blending processes; other uses and engineering data.

524 HYDRAULIC COMPONENTS

Hydraulic Press Mfg. Co., Hydraulic Power Div.—28-page condensed catalog covers the complete H-P-M line of hydraulic components. Includes descriptions and illustrations of hydraulic cylinders, valves, pumps, and power units.

Your NEW CATALOGS Guide offers readers of MECHANICAL ENGINEERING an opportunity to secure advertisers' latest industrial literature available. In this issue there are 524 items to make selections from. For convenience an index may be found on pages 43, 44 and 45. Select desired catalogs by number, requests limited to 25 catalogs. Fill in coupon on page 44 and mail promptly. *(Must be mailed on or before date given on coupon.)*

ENGINEERING OPPORTUNITIES
IN LONG RANGE
GUIDED MISSILE PROGRAM

ANALYSIS & DEVELOPMENT
OF POWER PLANT SYSTEMS

Challenging problems in:—

PNEUMATIC SYSTEMS
FUEL SYSTEMS
PRESSURIZATION SYSTEMS
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Recent graduate with BS or MS Degrees in M.E., A.E., and Chem. Engr., and experienced engineers with background in fluid mechanics, thermodynamics and/or heat transfer are invited to forward resume to:

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12214 Lakewood Boulevard
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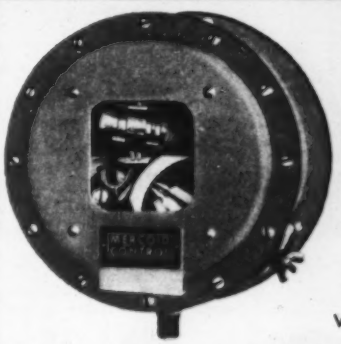
MERCOID
PRESSURE CONTROLS
FOR OUTDOOR SERVICE



Weather Proof
Drip Tight
Semi-dust Tight
Sleet Proof
Splash Proof
Moisture Resistant
Rain Tight
Water Tight

Equipped with
Sealed Mercury
Contacts

External Adjustments

Visible Calibrated Dial

AVAILABLE IN 17 PRESSURE RANGES FROM

0-30" VAC. TO 300-2500 PSI.

WITH THE SENSITIVITY YOUR APPLICATION REQUIRES

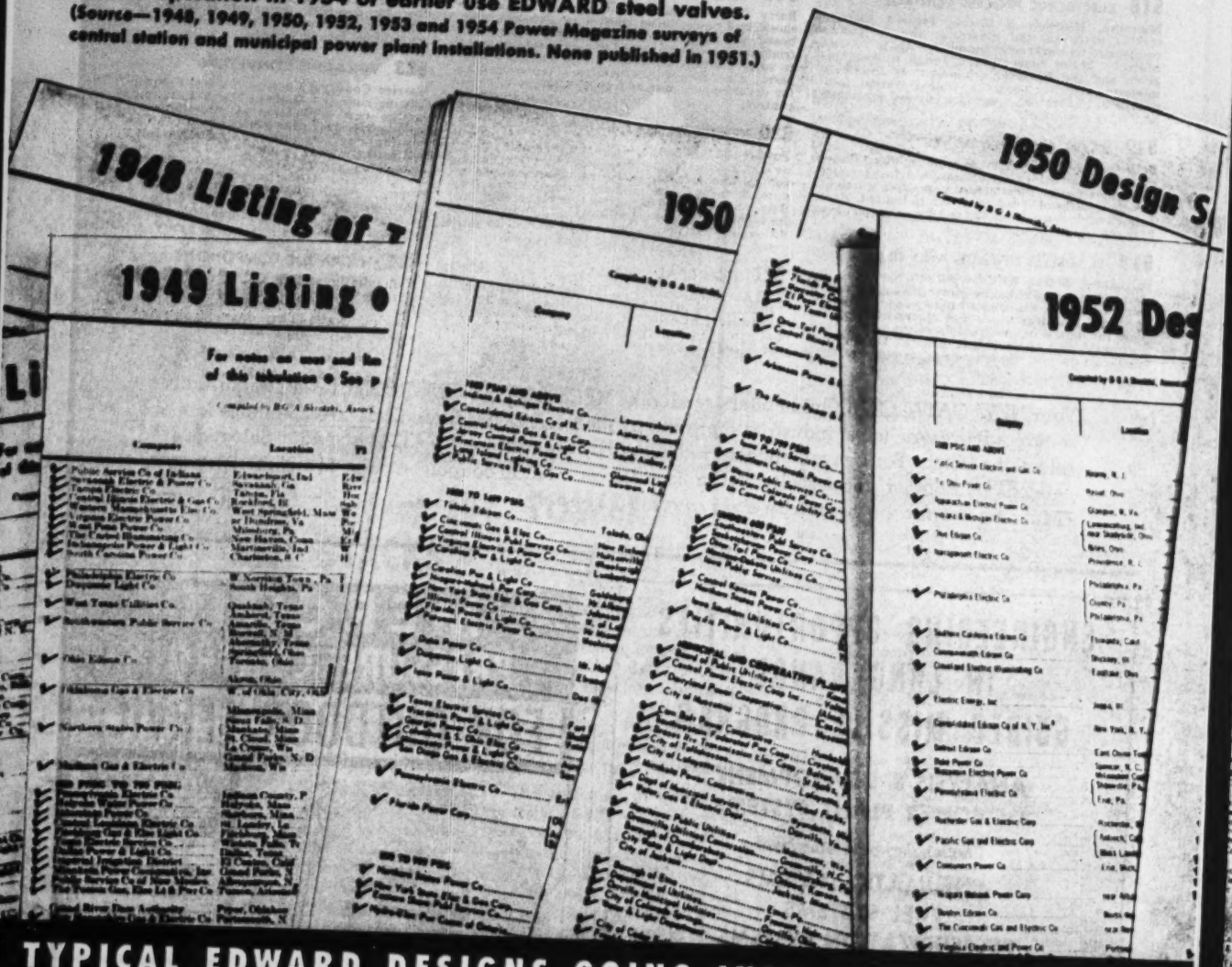
Mercoid weather resistant controls are also available for temperature and liquid level applications.

Write for Bulletin 14PW

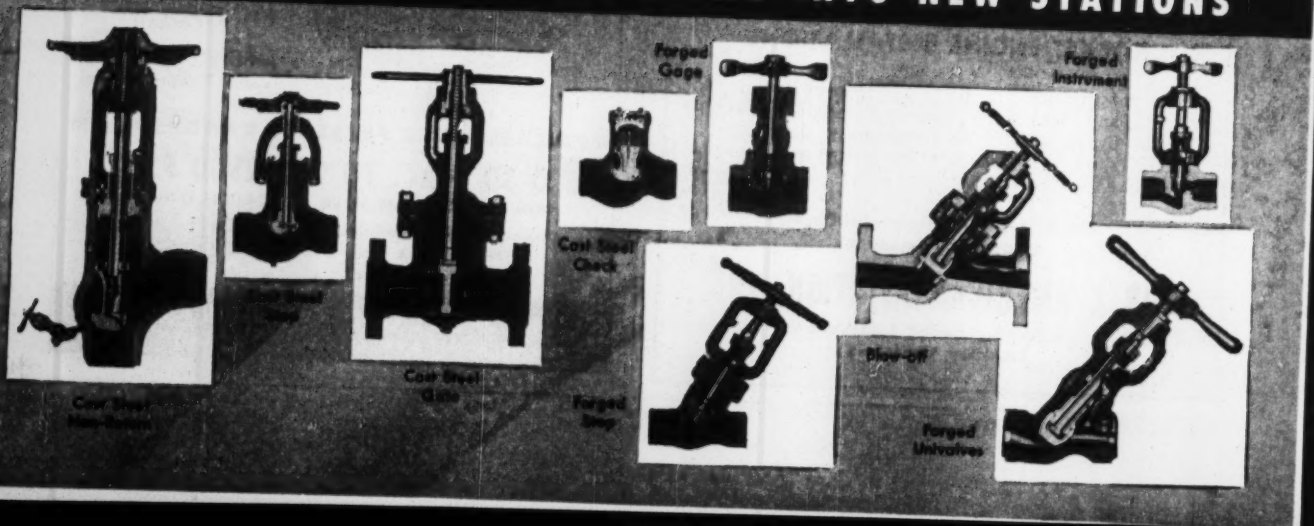
THE MERCOID CORPORATION
4201 BELMONT AVE., CHICAGO 41, ILLINOIS U.S.A.

Again in '54 it's Edward Valves

THE EVIDENCE: **674 out of 699 (96.42%) of new central station and municipal power plant projects scheduled to start operation in 1954 or earlier use EDWARD steel valves.**
(Source—1948, 1949, 1950, 1952, 1953 and 1954 Power Magazine surveys of central station and municipal power plant installations. None published in 1951.)



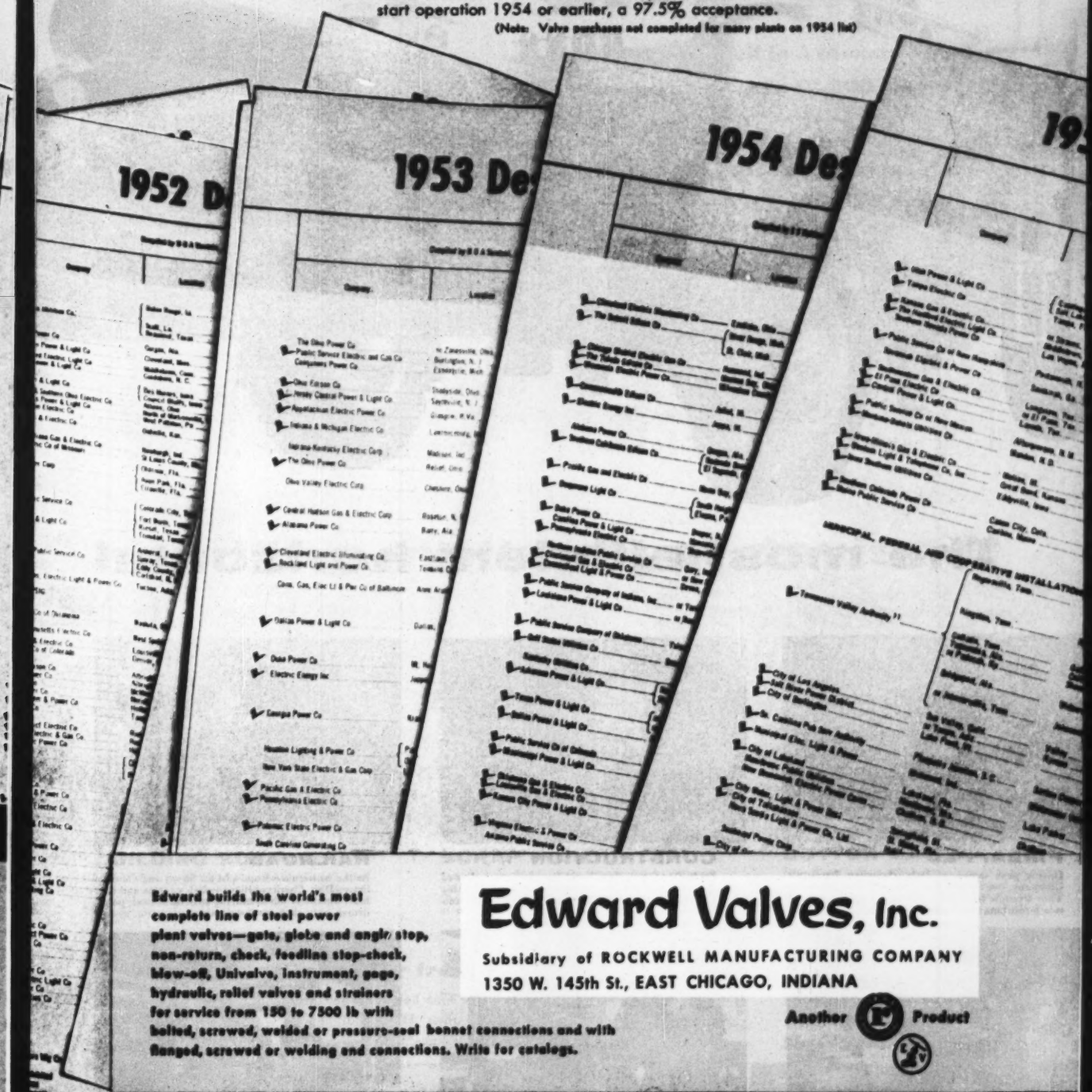
TYPICAL EDWARD DESIGNS GOING INTO NEW STATIONS



in over 96% of new power plants

✔ Indicates identified purchases of Edward valves for specific generating capacity additions. In the 1954 survey, records show Edward valves in 39 out of 40 new plant additions scheduled to start operation 1954 or earlier, a 97.5% acceptance.

(Note: Valve purchases not completed for many plants on 1954 list)



Edward builds the world's most complete line of steel power plant valves—gate, globe and angle stop, non-return, check, feedline stop-check, blow-off, Univalve, instrument, gage, hydraulic, relief valves and strainers for service from 150 to 7500 lb with bolted, screwed, welded or pressure-seal bonnet connections and with flanged, screwed or welding end connections. Write for catalogs.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

1350 W. 145th St., EAST CHICAGO, INDIANA

Another Product

ROSS

The most efficient horizontal

PINEAPPLE

During peak season at Dole Hawaiian Pineapple Company, two of these giant Carriers work as a team. They straddle the same highway trailer and remove two 8-ton bins simultaneously in one minute flat.

CONSTRUCTION

Fehlhaber Corp., New York City, covers a radius of 1½ miles between job-site and storage yard with this Carrier. It saves them $2.50 per ton of steel delivered to elevated-highway job.

RAILROAD

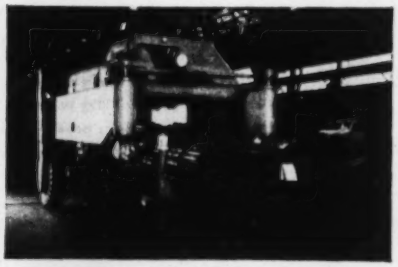
At the Milwaukee Road's Main Shops and General Stores Div., Carriers relieve switch engines and cars from the costly job of moving structural steel, poles, drums, etc., through the terminal.

AUTO FRAMES

A. O. Smith Corp. maintains a constant flow of sub-assemblies to their automotive frame assembly line with Carriers. A single man is able to transport 480 tons of material each 8-hour day.

HEAT EXCHANGERS

At a major Southwest refinery, this Carrier teams up with a boom truck to disassemble heat exchangers. The Carrier transports bundles, valves, pipe, etc. on wooden bolsters.



STEEL TUBE

The Gary plant of U.S. Steel's National Tube Div. employs this Carrier to transport billets to and from outdoor storage, and to handle a steady flow of tubing from one manufacturing stage to another.

CARRIER

. . . the one-truck fleet!

. . . loads itself in 5 seconds
. . . travels at speeds up to 56 mph
. . . unloads itself in 3 seconds
. . . capacities up to 50,000 lbs.

In the time it takes a full crew to load a comparable-capacity delivery truck, a Ross Carrier can frequently *complete* the delivery. Carrier operation is absolutely unique: there's no waiting time for loading or unloading. In 5 seconds the Carrier loads itself and takes off at road speed. You can schedule your deliveries or transportation in advance, then make up all the loads for Carrier pick-up. When the Carrier reaches its destination, it drops the load in 3 seconds and hustles back for the next. *Practically perpetual motion for this one-truck fleet!*

Revolutionary as it sounds, the Carrier has proved itself conclusively in scores of industries, some of which are pictured here. In many of these applications, a single Carrier has replaced two or even three conventional trucks. In all applications, no other kind of materials handling equipment could do the job so economically! This phenomenal success should compel you to ask yourself: *How much money can I save by changing or supplementing my present system with the Ross Carrier?* Every cost-conscious company should know the answer.

handling method yet devised!

BUILDING SUPPLIES

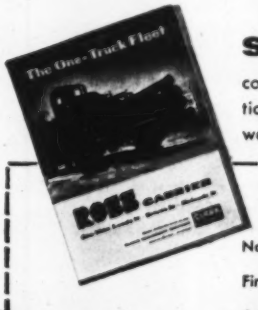
Rather than go to the expense of installing a spur track to service an across-the-street warehouse, Carter-Lee Lumber Co., Indianapolis, bought this Carrier; they also use it for street delivery.

SCRAP IRON

Central Iron & Metal Co., Battle Creek, replaced six trucks with two of these Carriers. They handle 30,000 lb. scrap loads in "gondolas" which are left at customers' yards.

COTTON BALES

Four Ross Carriers deliver 15-bale loads to the docks at Corpus Christi from the warehouse of Gulf Compress Company. The Carriers make the 2½ mile round-trip in 15 minutes.



Send for free booklet . . .

containing illustrated case histories which show Ross Carrier-operations in food, steel, scrap iron, petroleum, transportation, metal-working and construction industries.

ROSS CARRIER DIVISION
CLARK EQUIPMENT COMPANY
Benton Harbor 88, Michigan

☐ **Send Carrier booklet**

Name_____

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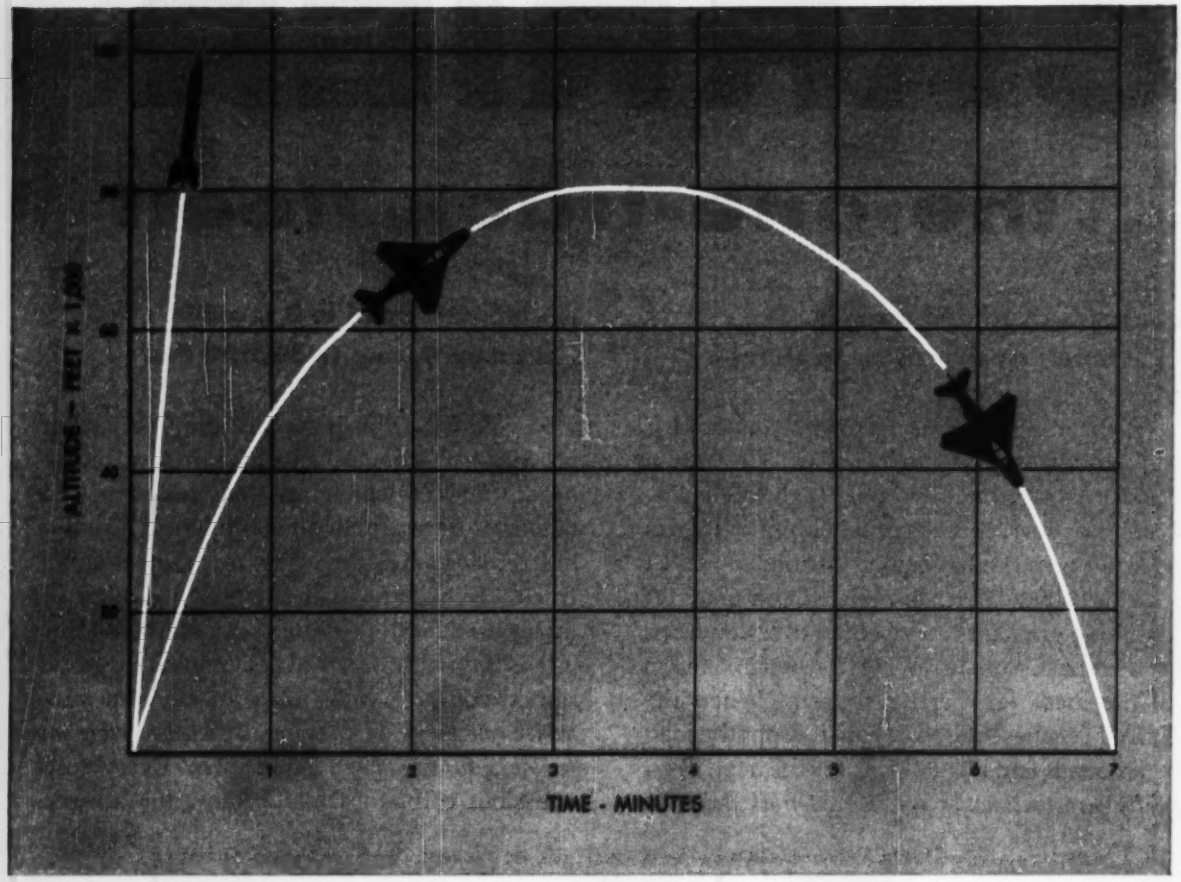
CLARK EQUIPMENT



Sea Level to 80,000 Feet *in Three Minutes*

One of the many successful applications of Hagan Automatic Control is simulating flight conditions for testing jet engine components.

The automatic control system changes test chamber pressure (on a programmed basis), from sea level to 80,000 feet in three minutes. The program can be stopped at any altitude setting, for automatic control of a steady test chamber pressure.

For this installation, a programmed pneumatic signal dictates test chamber pressure to a regulator for conversion into a controlling signal to a hydraulic pilot valve. This, in turn, directs high pressure oil to a linear travel power unit for extremely fast and accurate operation of the controlling damper.

This Is Important

The same Hagan Automatic Control System is ready now for simulating flight to 80,000 feet in six seconds.

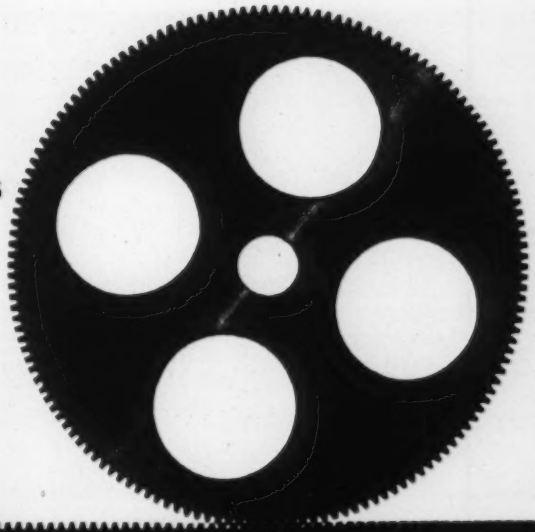
With the equivalent system utilizing Hagan electronic control elements, programmed trajectories from sea level to 100,000 feet in three seconds are obtainable.

HAGAN
HALL
BUROMIN
CALGON

Hagan Corporation
AERONAUTICAL AND SPECIAL PRODUCTS DIVISION
HAGAN BUILDING, PITTSBURGH 30, PA.

Control Systems for Automotive andAeronautical Testing Facilities
Ring Balance Flow and Pressure Instruments
Metallurgical Furnace Control Systems
Boiler Combustion Control Systems

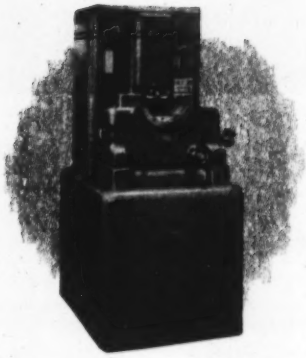
Here's *Why* you can check precision gears *more conclusively* with Kodak Conju-Gage Gear Checkers



Why the composite check

Errors in gears seldom occur individually—they're usually combinations of as many as six types of errors. The practical way to test gears for these errors is to test them in action through the composite check recommended in the new American Standard (AGMA 236.02; ASA B6.11-1951).

This check measures gear errors as variations in center distance when the gear is rotated in contact with a master of known accuracy. Since this variation is the sum of errors in both gear and master, the degree of precision measurable depends on the precision of the master.



The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4½" pitch diameter. Larger and smaller models are also available.

Why the Conju-Gage Gear Checker

Kodak Conju-Gage Gear Checkers use a master of exceptional accuracy, the Kodak Conju-Gage Worm Section. These Worm Sections are generated by the continuous action of a thread grinder under control of a precision lead screw—circular pitch error and tooth thickness variations cannot be introduced by defects in an intermittent indexing mechanism. This means a more accurate gaging element, less chance that error in the master may coincide with a tolerable error in the gear to result in a needless rejection. Less chance, too, that an error in the master may subtract from an intolerable error in the gear, passing a gear that will fail in use.

By passing each right gear, rejecting each wrong gear, the Kodak Conju-Gage Gear Checker helps you reduce costs while maintaining highest precision. For the full story of this and other economies achieved by Conju-Gage instrumentation, send for the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

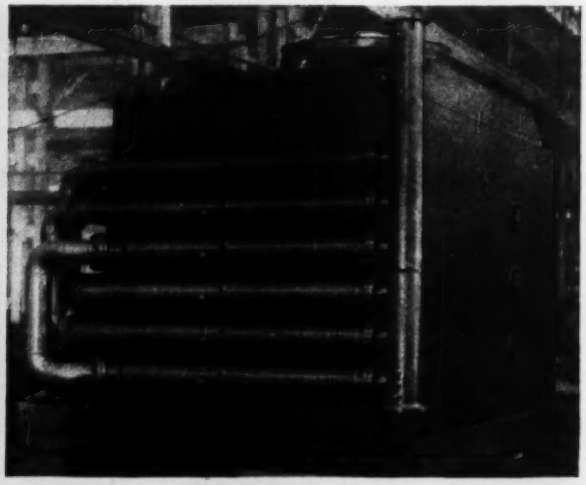
Special Products Sales Division
EASTMAN KODAK COMPANY, Rochester 4, N.Y.

CONJU-GAGE INSTRUMENTATION

. . . a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak



Even the most specialized exchangers and condensers

get a head start here!

On the assembly floors of the Kewanee-Ross plants in Buffalo, N. Y. and Kewanee, Ill., are Ross Exchangers and Surface Condensers of numerous designs.

Some are completely standardized . . . some partly standardized . . . others completely special.

But *all* have a big point in common: *They were off to a head start from the time Ross engineers were first consulted.*

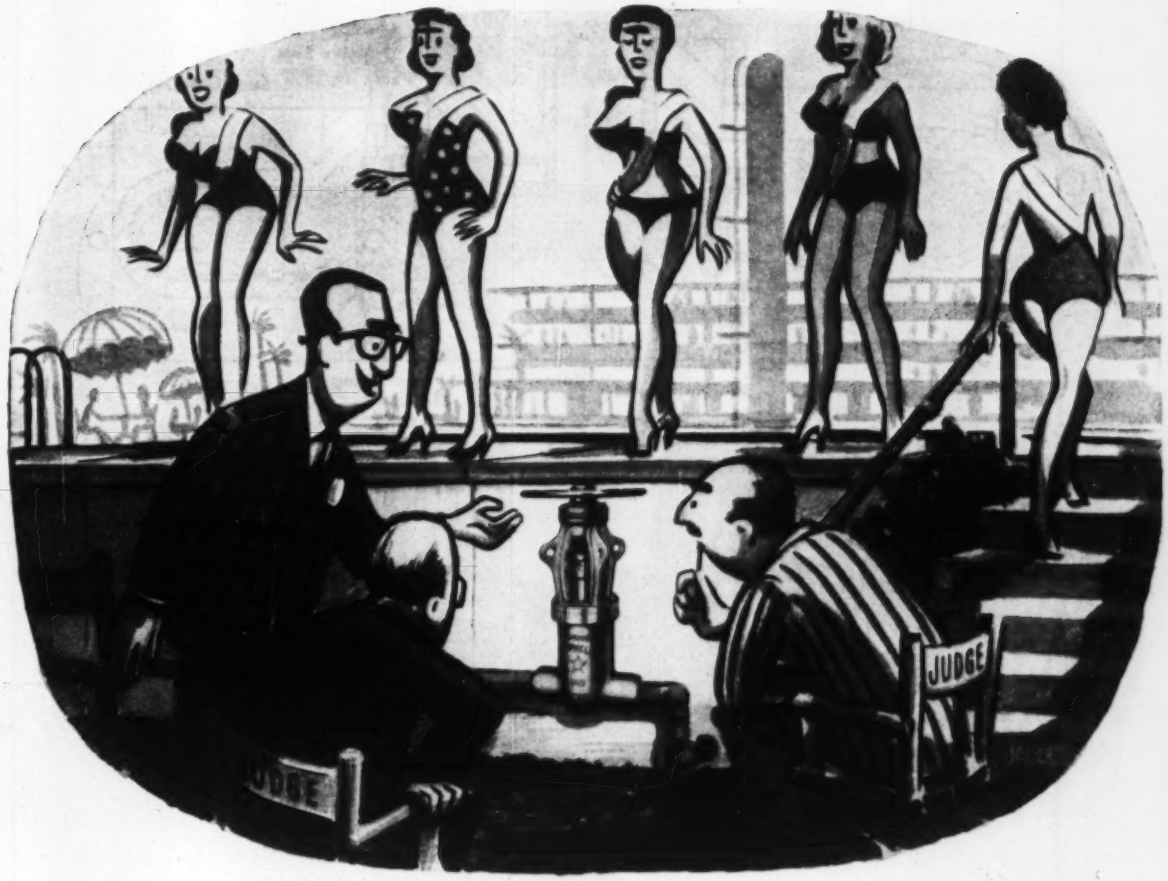
Unsurpassed experience with a tremendous variety of both standard and special designs is usually able to produce successful precedents for most requirements. Often, for even the most specialized needs, standard components in a wide range of working pressures can be utilized at tremendous savings in cost and time . . . flanges, shell and floating head covers, tube sheets, tube layouts, shells, channels, for example. And from the all-important standpoint of fabricating facilities, the two, large, modern plants of Kewanee-Ross are equipped with the latest machines and tools to do the job better and faster.

Before you form your own opinion on how complex or specialized your condenser or exchanger has to be to meet your requirements, consult with a Kewanee-Ross engineering representative. A short talk can well result in many shortcuts to a satisfactory solution.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1448 WEST AVENUE • BUFFALO 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



"You see Powell Valves everywhere! And with . . .

. . good reason! They're famous for dependability. Economical, too.
What's more, Powell has a complete line."

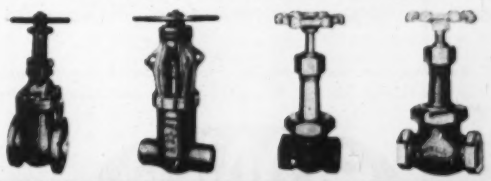
Famous for dependability

SINCE 1846

Wherever flow requires dependable control, there's *the* place for Powell Valves. Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

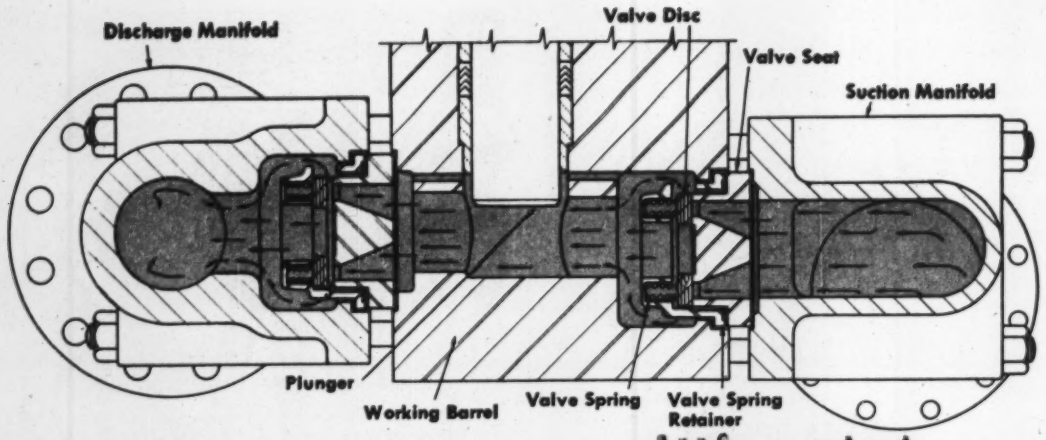
Available through distributors in principal cities. Made ⅛" to 30" and for 125 pounds to 2500 pounds W.S.P. Bronze, iron, steel and corrosion-resistant metals and alloys. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY

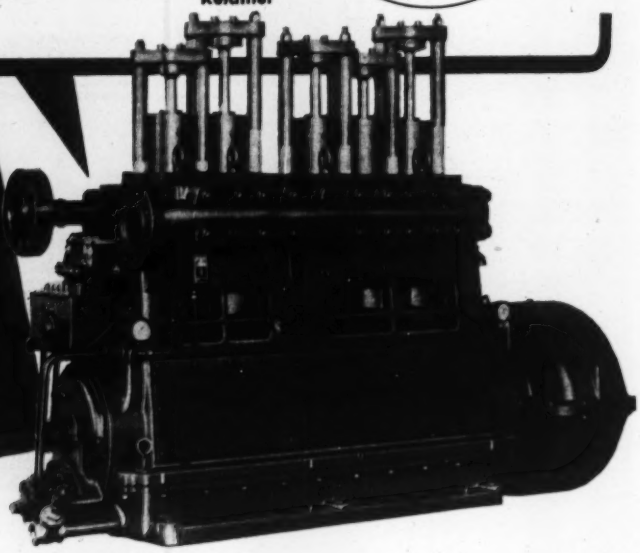


Powell Valves

108th year



ENGINEERS: Check these points of Aldrich Direct Flow Design



Aldrich engineers eliminated two right-angle turns in the fluid-end. Now, liquid passes from suction to discharge manifold in a *straight line.* That gave the Direct Flow Pump its name, and set up a whole new concept of pumps, pumping, and pump maintenance. It all adds up as follows:

☐ **Increased operating speeds**—you get whatever volume and pressure you need *from a smaller, lighter, more compact pump.*

☐ **Sectionalized construction**—parts can be replaced at a fraction of the cost of a new fluid-end; also, parts can be made of stainless, bronze, Monel or other special materials—extremely important for corrosive fluid service.

☐ **Maintenance made easier**—no more tapered bores in the working barrel. Manifolds are *not* taken off but slide out on studs—affording room to *lift out* valves as complete units. Packing is easily renewed—note accessibility of stuffing boxes.

☐ **Interchangeable wearing parts**—available among 3, 5, 7 and 9 plunger pumps of same stroke size. This minimizes spare parts costs and inventories.

☐ **Changeable plunger sizes**—in many cases it is only necessary to add new plungers, glands, throat bushings and packing *to the same fluid-end.*

☐ **Drive direct**—by connection to synchronous engine type motor or internal combustion engine; also with integral speed reducer or V-belts.

Contact your Aldrich Representative . . . or write to us direct for complete details on 3", 5" or 6" stroke units.

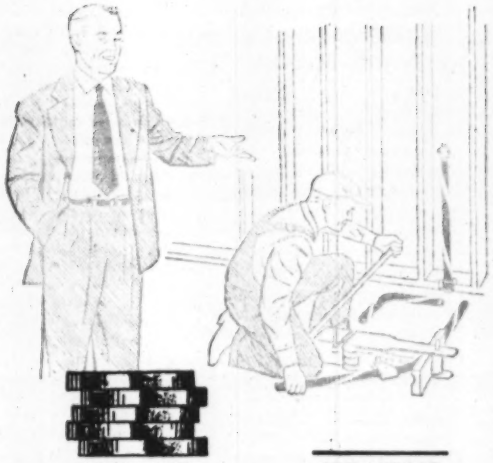
THE ALDRICH PUMP COMPANY

29 PINE STREET • ALLENTOWN, PENNSYLVANIA

. . . Originators of the Direct Flow Pump

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Carmi, Illinois • Charleston, W. Va. • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Duluth Houston • Los Angeles • New York • Oakland, Calif. • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. • Rochester • Salt Lake City • San Francisco • Seattle Somerville, Mass. • Spokane, Wash. • Syracuse • Tulsa • Washington, D. C. • Youngstown • Export: Petroleum Machinery Corp., 30 Rockefeller Plaza, New York 20, N. Y.

WHICH WILL IT BE...



INSTALLED COSTS

PREMATURE REPAIRS

INSTALLED COSTS

PREMATURE REPAIRS

a little more NOW—or a lot more LATER?

Let's take a close look at this so-called higher cost of wrought iron pipe.

All too often, INITIAL COSTS are used as the only basis of comparison. The fallacy of the initial-cost-yardstick has been proved time and time again in installations where low-first-cost piping has been installed and has failed prematurely. The original installation was quickly made by pipe fitters. But repairs call for hours of work by as many as five craftsmen—pipe fitters, masons, carpenters, plasterers, painters. And labor costs are only part of the picture. The indirect costs of production slowdowns and disrupted routine swell the total of every premature pipe failure. It's easy to see how this first failure can wipe out initial "savings" many times over.

The only *valid comparison* of piping costs is INSTALLED COSTS *plus* REPAIRS. This yardstick places the emphasis where it rightly belongs . . . on SERVICE LIFE. In installation after installation, wrought iron pipe has doubled, tripled and even quadrupled the useful service life previously obtained from low-first-cost piping. All this adds up to one thing . . . the fact that you pay a little more for wrought iron means that you pay a LOT LESS FOR MAINTENANCE. Wrought iron gives you *piping economy,* because it lasts longer, at lower cost per year!

If you are concerned about piping services where corrosion is a threat to durability, you'll find it profitable to investigate the longer life of wrought iron pipe. Our Engineering Service Department will be happy to send you examples of typical wrought iron service records in installations similar to those in which you are interested. Write or call.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Department: New York, N.Y.

Why Genuine Wrought Iron Lasts

This notch-fracture test specimen illustrates the unique fibrous structure of wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glasslike silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

For the latest construction and inspection rules, consult these sections of the

POWER BOILER CODE

1952 $3.00

Covers the construction of power boilers to be used in stationary service and the piping connections up to and including the valve or valves as required by the code; unfired pressure vessels in which steam is generated; superheaters, economizers, and other parts connected directly to the boiler without intervening valves; and reheaters receiving steam which is passed through part of a turbine or other prime mover. The appendix provides formulas for calculating efficiency of joints and for computing the allowable loads on stay bolts and braces; information on checking safety valve capacity; fusible plug; hydrostatic tests; temperature-pressure ratings; and dimensions.

SUGGESTED RULES FOR CARE OF POWER BOILERS

1954 $3.00

These recommendations encompass procedures for operating and maintaining steam boilers and appliances, internal and external inspection of boilers, installation, power boiler auxiliaries, internal cleaning and the laying-up of boilers, corrosion, cracking and embrittlement of boiler steels, steam contamination, etc. Additionally, there are rules for prevention of direct causes of boiler failure for those who wish to make a more comprehensive study of the care of steam boilers in service.

UNFIRED PRESSURE VESSEL CODE

1952 Edition with 1954 Addenda $5.50

Provides the general requirements for all methods of construction and the specific requirements for unfired pressure vessels of carbon and low alloy steels, non-ferrous metals, high alloy steels, cast iron, and clad and lined material fabricated by welding, riveting, integral forging, and brazing; three mandatory appendixes giving design formulas, rules for bolted flanged connections, and definitions; and sixteen non-mandatory appendixes supplying useful information to both the designer and inspector.

ASME BOILER AND PRESSURE VESSEL CODE

LOW-PRESSURE HEATING BOILER CODE

1952 $1.25

These rules are for steam boilers operating at pressures not exceeding 15 psi and for hot water boilers operated at pressures not exceeding 160 psi or temperatures not exceeding 250 F, constructed of cast iron and steel plate.

LOCOMOTIVE BOILER CODE

1952 $1.25

Construction and maximum allowable working pressure, plates and tubes, boiler joints, braced and stayed surfaces, riveting, safety valves, fittings, hydrostatic tests, welding, and sampling are details covered.

MINIATURE BOILER CODE

1952 $1.00

The provisions of this Code are for fired pressure vessels which do not exceed 16 in. diameter of shell, 42 in. over-all length of outside to outside of heads at center, 20 sq ft water heating surface, and 100 psi.

WELDING QUALIFICATIONS

1953 $1.50

Covering requirements for ferrous and nonferrous materials, this Code recommends, (1) the tests required to qualify the welding procedures a manufacturer uses in the construction of weldments built under this code and (2) the test rules for determining the ability of the welder or welding operator to make sound welds. Definitions of welding terms, information on etching processes and reagents, and specimen forms for recording tests are included.

MATERIAL SPECIFICATIONS

1952 $7.50

Contains 115 specifications for the important materials used in the construction of boilers and pressure vessels.

Published by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 W. 39th St., New York 18, N. Y.

CONCERNING CODE ADDENDA

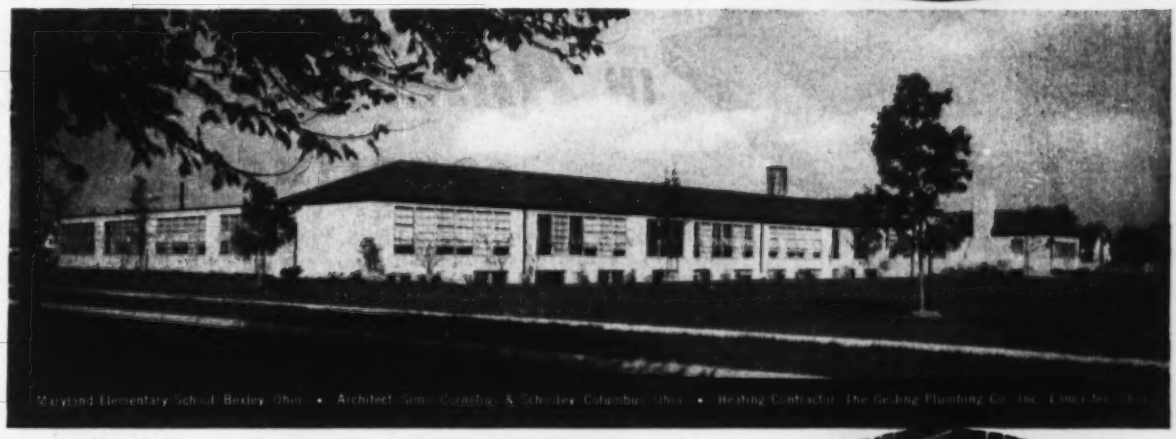
The 1954 Addenda to the 1952 ASME Unfired Pressure Vessel Code have just been published. Included are the changes affecting over forty code rules, several new provisions, and a number of new sketches and charts. Among the important additions are the new rules for permissible out-of-roundness of cylindrical shells provisions for using split loose flanges, new materials and stress values for tables UCS-23 and UHA-23, fourteen charts for use in the design of vessels under external pressures, and the pressure-temperature ratings for steel pipe flanges and flanged fittings. Price $1.50.

For publication in December—1954 ADDENDA TO THE 1952 POWER BOILER CODE.

Included in this 40-page pamphlet are revisions to some twenty of the existing rules, new requirements and a 14-page table of temperature-pressure ratings. Many of the sketches have been redrawn and new drawings added. Price $1.50.

20% Discount to ASME members

YOU CAN'T PUT A PRICE TAG ON THEIR FUTURE



Maryland Elementary School, Bexley, Ohio • Architect: Sims, Crawley & Schooley, Columbus, Ohio • Heating Contractor: The Geiting Plumbing Co., Inc., Lancaster, Ohio

KEWANEE Reserve Plus Rated boilers certify heat to meet all conditions

One of America's greatest assets is school children . . . from their ranks come the leaders of tomorrow. Their well-being depends on adequate facilities to guard health . . . meet future needs. There can be no price tag here so thoughtful school boards and those who design, build and equip the nation's schools, plan wisely. Take the matter of heat. There must be enough boiler capacity to provide healthful temperatures. Because every Kewanee Boiler is certified to deliver 50% extra reserve power, adequate heat is always available. Kewanee Reserve Plus Rated Boilers guarantee enough power for any emergency . . . for fluctuating demands, and equally important, they provide for expansion. School enrollment is growing at the fastest tempo ever, so the need for rapid expansion is often critical.

Be sure you follow the Kewanee Reserve Plus Rating Plan in considering boilers. Know these important facts:

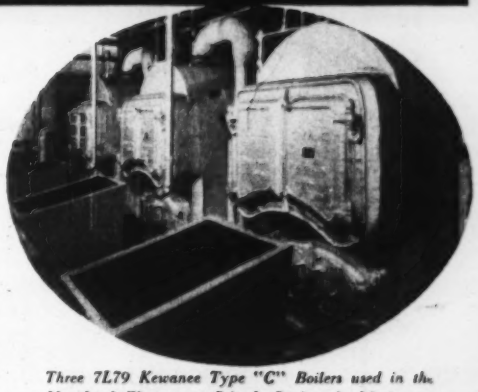
1—*Boiler rating must be based on nominal capacity, not maximum capacity;*

2—*Boilers must have sufficient built-in reserve to meet changing demands;*

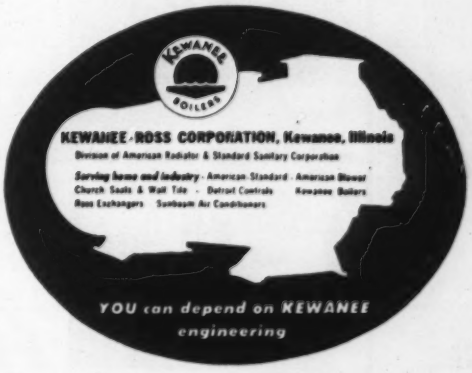
3—*Boilers must have sufficient capacity to operate at "cruising speed," not maximum speed at all times;*

4—*Like examples must be considered in comparing boilers. Don't be confused by vague technical claims.*

Choose Kewanee and cut fuel costs—lower maintenance—reduce breakdowns—get longer boiler life.



Three 7L79 Kewanee Type "C" Boilers used in the Maryland Elementary School. Student health is protected because there's sufficient reserve to meet every need . . . provision for expansion, too.


KEWANEE BOILERS
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YOU can depend on KEWANEE engineering

The Amerigear® patented fully crowned tooth form...

...IS THE SOURCE OF

High Misalignment Capacity*

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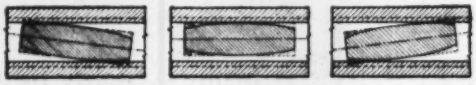
COUPLINGS

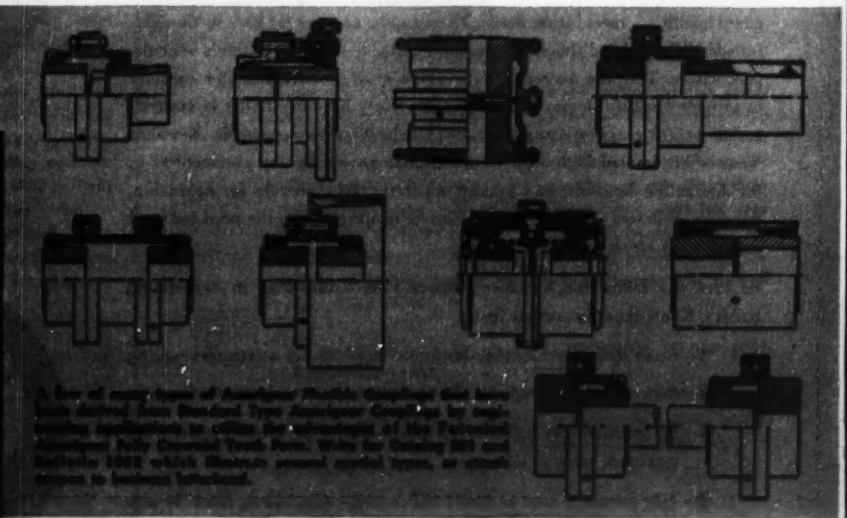
● An engineered application, using advantages of the Patented Amerigear HMC* Flexible Coupling, can solve any power transmission problem arising from:

- **Excessive lateral and angular misalignments;**
- **Tight backlash requirements;**
- **Space limitations;**
- **High speeds and loads;**
- **Continuous operation;**

or any combination of these



Comparison with gearing of conventional gear-type couplings shows how Patented Amerigear Tooth Form eliminates *tooth end loading* and simultaneously allows for both lateral and angular misalignment. Dotted lines indicate gear teeth of conventional gear couplings.



Amerigear® HMC* FLEXIBLE COUPLING

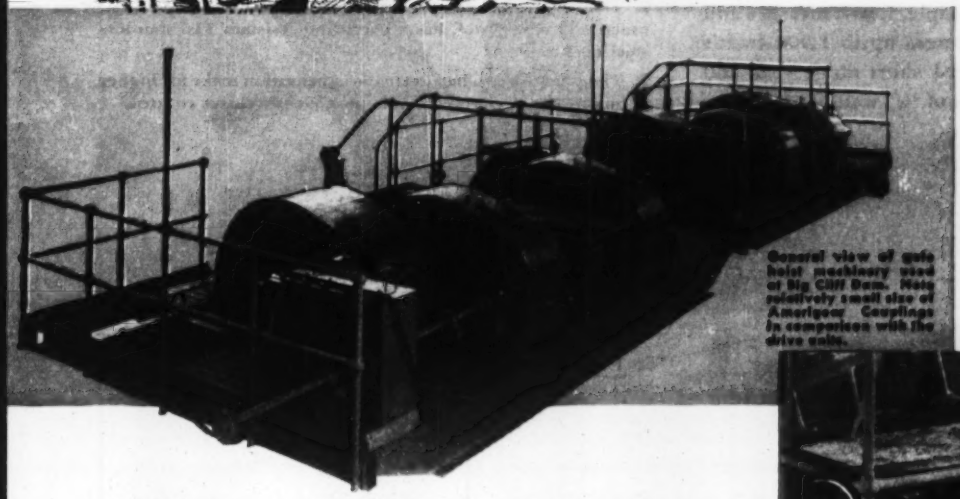
One of several standard types embodying the Patented Amerigear Tooth Form

Patented and Patents Pending

Amerigear HMC* COUPLINGS

HELP TAME THE RIVER GIANTS...

transmitting power to raise and lower four 42 x 39 foot gates in fluctuating service at Big Cliff Dam



General view of gate hoist machinery used at Big Cliff Dam. Note relatively small size of Amerigear Couplings in comparison with the drive units.

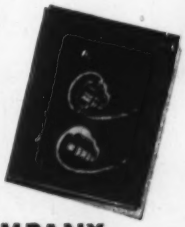
Close-up of a portion of the gate hoist machinery, prior to installation. Hanger bearings are placed at eight foot centers. Two couplings are used on each shaft. Amerigear Coupling shown is one of several standard types available.

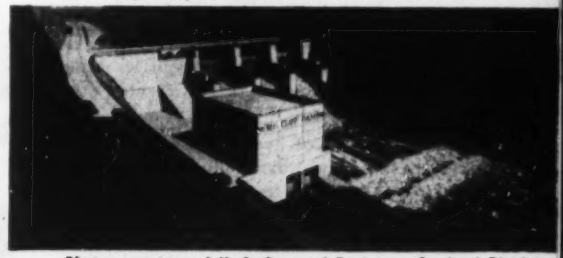
View of standard Amerigear Coupling placed between motor drive and speed reducer and Cut-Out Type Amerigear Coupling with Shifting Collar and lever between reducers.

Artist's conception of Big Cliff Dam on North Santiam River, Oregon. This 18,000 kilowatt project, and the Detroit Dam upstream, perform invaluable service in flood control, conservation and power production.

Built for the purpose of re-regulating the fluctuating discharges effected by the "Detroit" Dam three miles upstream, the "Big Cliff" Dam is located on the North Santiam River in Oregon. One hundred eighty-two feet from foundation to deck, the Big Cliff Dam is controlled by four radial gates—no mean assignment against the forces of water roaring through the one hundred ninety-two foot ogee spillway, out of a nearly three-mile reservoir. Four triple-reduction, herringbone gear speed reducers, coupled with Amerigear HMC* Flexible Couplings do the job — fufilling every requirement for precise, positive operation. Designed to operate effectively under sustained heavy loading or intermittent shock loading, Amerigear HMC* Couplings minimize the effects of any lateral or angular misalignment that may occur. Thus, efficient transmission of power, with minimum wear or maintenance, is assured. Similar power transmission problems involving tight backlash requirements, space limitations or high speeds, can be solved with equal success by use of Amerigear HMC* Couplings.

HMC* stands for High Misalignment Capacity; engineered into *every* Amerigear Coupling.





Photos, courtesy of U. S. Corps of Engineers, Portland District and Monarch Forge and Machine Works.

Amerigear Engineers are available to assist in engineering special applications and for adapting Amerigear Standard Type Couplings to solve your power transmission problems.

Write for Catalog 501 and Bulletin 1052, or attach coupon to your business letterhead.

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Please send me further information regarding AMERIGEAR COUPLINGS with the Patended Fully Crowned Tooth Form as described in Catalog No. 501 and Bulletin 1052.

Name ..... *Title* .....

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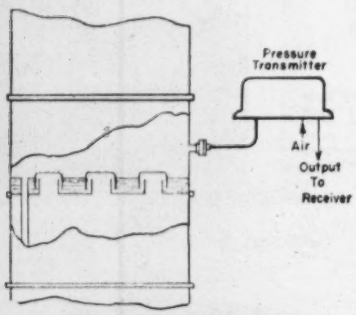
TRANSAIRE® Pressure Transmitter solves these tough problems!

Measuring within ½% of 20-40 psi shiftable range spans

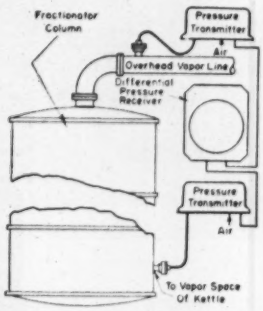
THE Taylor TRANSAIRE Pressure Transmitter with short, shiftable spans gives unprecedented accuracy and sensitivity—plus the convenience of suppressed ranges at high pressure levels. Operating on the simple force-balance principle, it will measure and transmit minute pressure changes up to 1,000 ft. It's accurate to ½% of the selected short range span and sensitive to pressure changes of ½" water.

THREE IMPORTANT ADVANTAGES

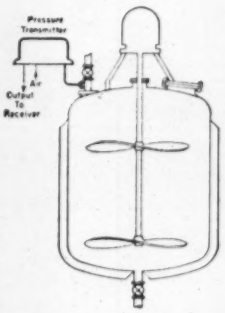
1. Range spans of 20 and 40 psi are available throughout the range limits of 35 to 415 psia; 50 to 100 psi throughout 100 to 1,000 psia.
2. The volumetric type pressure system is extremely accurate, practically clog-proof, has a corrosion-resistant 316 stainless steel diaphragm.
3. Temperature and barometric compensation make for higher accuracy of measurement, and consequently closer control.



COLUMN PRESSURE



COLUMN PRESSURE DROP



REACTOR PRESSURE

NARROW RANGE SPAN DETECTS PRESSURE TRENDS

Problem: To get highest possible purity of product consistent with good production economy. This requires the quick detection of pressure trends over a very narrow range.

Solution: The short, shiftable range spans (as short as 20 psi) of the TRANSAIRE Pressure Transmitter permit selection of operating range by a simple screw-driver adjustment. Its high order of sensitivity enables the operator to detect minute changes of pressure.

Result: Close control, because the minute pressure trends are practically instantaneously detected and transmitted to the controller and receiver. This means higher yield of a purer product, also great flexibility in changing to different product requirements.

PERMITS MAXIMUM CAPACITY OPERATION

Problem: To operate a column at maximum capacity, consistent with the preventing of flooding.

Solution: As the pressure drop across the column is a measure of the vapor velocity, the measurement of this drop with a short-range, highly sensitive, easily adjustable instrument enables the operator to keep the column safely close to the flooding point.

Result: Maximum production and uniform operation.

FLUSH SURFACE IS CLOG-PROOF

Problem: To measure pressure in reactor kettles containing viscous or corrosive liquids which tend to clog conventional measuring systems.

Solution: The closed volumetric measuring system of the TRANSAIRE Pressure Transmitter presents a flush surface on the inside of the vessel. It is clog-proof, highly sensitive and provides an accurate reading.

Result: Maximum yield of high purity product and a precise knowledge of the pressures maintained.

Ask your Taylor Field Engineer, or write for **Bulletin 98097.**
Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

Taylor Instruments MEAN ACCURACY FIRST

When something's got to give
to compensate for expansion,
contraction, vibration, rotation or strain,
in your piping system or equipment,
it will be far, far better for you
if the "something" that gives
is a Zallea Expansion Joint
and not your expensive piping.
Since piping damage usually
means down-time, it pays
to provide positive, over-all protection.

The expansion joints illustrated,
duo-equalizing, hinged, and universal,
are just a few of the Zallea family
of expansion joints available
to help solve your piping problems.

Regardless of piping movement,
whether axial, lateral, rotational,
etc., Zallea already has, or will
design, an expansion joint to absorb it.
For information on standard types,
request Bulletin 351. For consultation
on special problems, ask us to
have our representative call.

Zallea

expansion joints

ZALLEA BROTHERS, 820 LOCUST STREET, WILMINGTON 99, DELAWARE

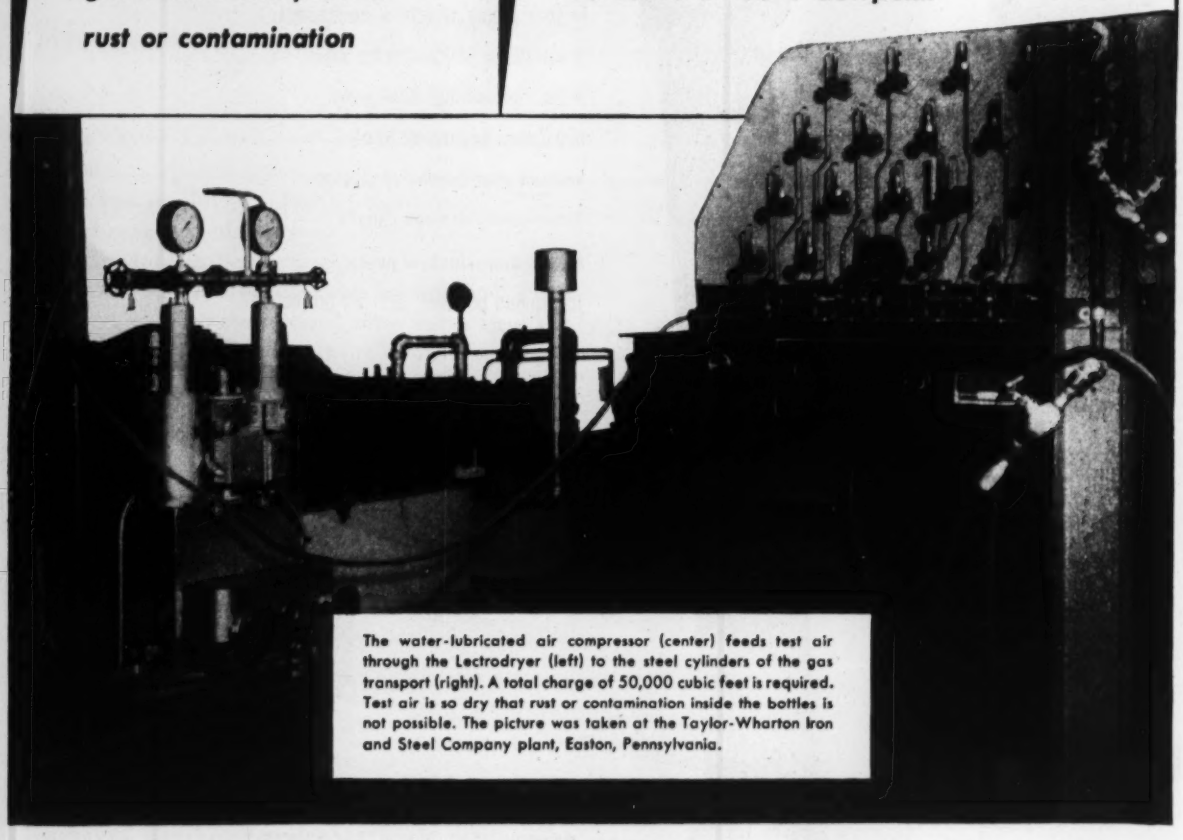
World's Largest Manufacturers of Expansion Joints

WANTED:

a way to dry out steel gas bottles and prevent rust or contamination

SUPPLIED:

by a 3000 psig Lectrodryer, drying test air to a -50°F dewpoint



The water-lubricated air compressor (center) feeds test air through the Lectrodryer (left) to the steel cylinders of the gas transport (right). A total charge of 50,000 cubic feet is required. Test air is so dry that rust or contamination inside the bottles is not possible. The picture was taken at the Taylor-Wharton Iron and Steel Company plant, Easton, Pennsylvania.

An important part of the testing procedure in the Gas Transport Department of the Taylor-Wharton Company is the testing of the assembled cylinders and manifold by air at 2,400 psi. To assure freedom from contamination, the test air must be dry.

This air is dried by a Lectrodryer*. It extracts all harmful moisture, to a level where contamination or rust within the cylinders is not possible (−50° F dewpoint).

Perhaps you require similar dryness somewhere in research, production or test processes. Lectrodryers of many types and sizes are available to dry air, or other gases, in large or small volume, to dewpoints as low as −100° F. Write for literature or engineering information. Pittsburgh Lectrodryer Corp., 335 32nd Street, Pittsburgh 30, Pa.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
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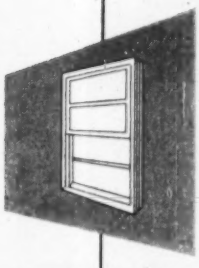
LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

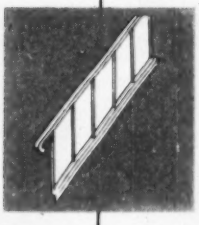
LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

Something NEW has shaped up at WOLVERINE



Prime Windows and Doors



Architectural and Decorative Shapes

Transportation

Combination Storms and Screens

Here's BIG news for product design engineers. Wolverine has parlayed its Tubemanship ability into the manufacture of extruded aluminum shapes.

And the results: brand new horizons for designing.

Wolverine aluminum extrusions are light, yet strong. They can't rust, need not be painted. And most important, Wolverine can produce extruded aluminum shapes to your specifications. After all, Wolverine has done it with tubing for years.

There are plenty of other advantages to Wolverine extrusions, too. Just write—today—for complete details. Alloys? 1100 (2S), 3003 (3S), and 6063 (63S). WOLVERINE TUBE, Division of Calumet & Hecla, Inc., 1483 Central Avenue, Detroit 9, Michigan.

Be SURE to specify Wolverine extruded aluminum shapes

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

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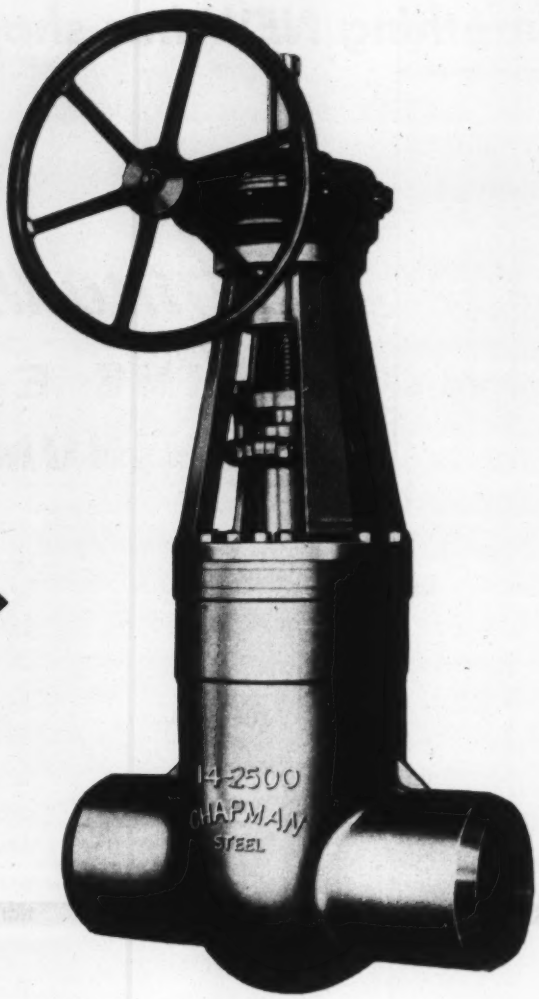
Two Reasons why
CHAPMAN
STEEL VALVES
Keep Maintenance Low in High Pressure Service



Carefully-formulated alloys and *accurately-detailed contours* give Chapman Steel Valves unexcelled dependability under the most severe high pressure and high temperature conditions.

Fourteen alloys are made in Chapman's own foundry, under rigid laboratory supervision, to ensure that every valve is made of the right steel for its specific service.

Precision manufacture to close tolerances is *standard* in Chapman Steel Valves. Designs have been refined to meet the demands of years of smooth operation at minimum maintenance costs. Quality is unsurpassed.

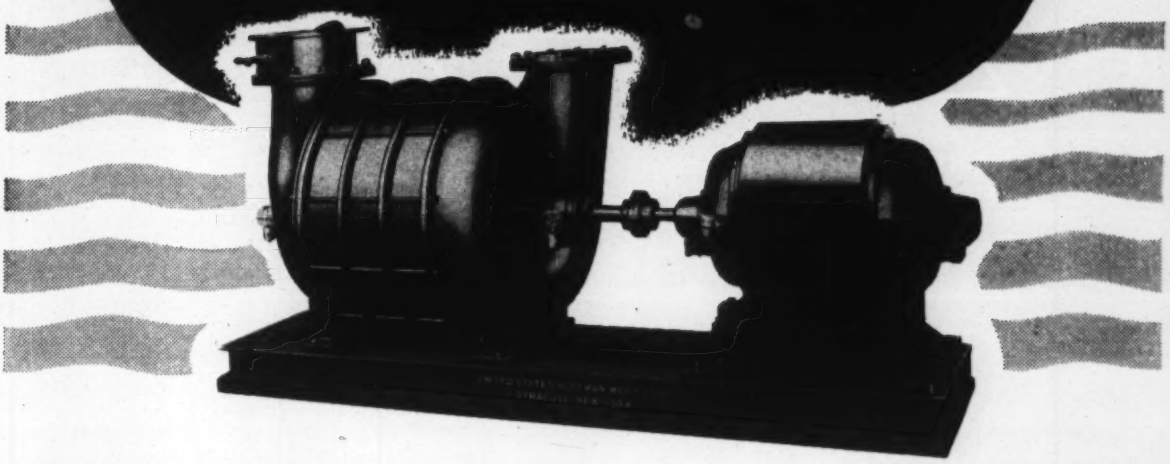
For gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900, 1500 and 2500 psi — and for temperatures to 1150°F, see Chapman first. Valves are supplied with welded, pressure seal or bolted bonnet joints and with flanged or welding ends. Valves equal or exceed ASA standards in every range.

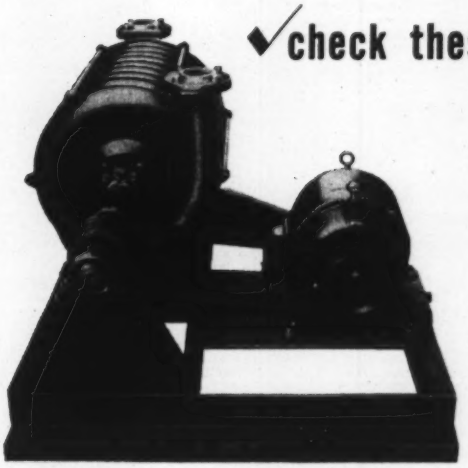
Write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

FOR THE *LONG* BLOW

at LOW cost and HIGH dependability...



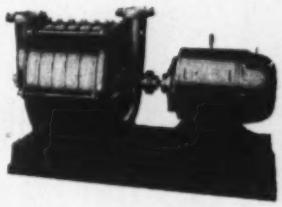


✓check these HOFFMAN multistage centrifugals

When it's economical, trouble-free, and *sustained* movement of air you want—up to 9 pounds of pressure *or* 12 inches of vacuum—be sure to look into the Hoffman Multistage Blower and Exhauster.

You'll be intrigued with the design . . . the way it combines effectiveness and simplicity. Just one moving part, dynamically balanced—and the absence of valves, vanes, pistons, gears, and all reciprocating or contacting elements—mean silent, vibrationless operation.

The multi-effect impeller delivers its flow without pulsation at constant pressure for volumes within the capacity limits. Power consumption is directly proportional to the volume of air handled. With no internal lubrication—there is no oil contamination of air.



Detailed information on the Hoffman Multistage Blowers, specifications and performance data, is now available in our new Bulletin M-103.

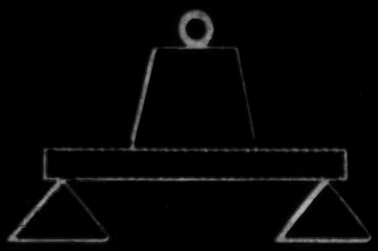
We'll be delighted to send you a copy—it's the right size for your files. Please address—

AIR APPLIANCE DIVISION

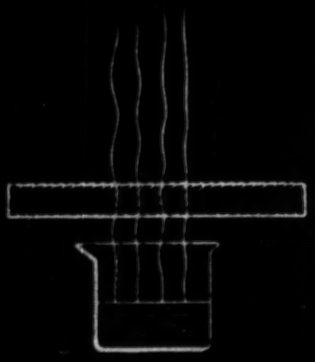
U. S. HOFFMAN MACHINERY CORPORATION

DEPT. ME, 105 FOURTH AVENUE, NEW YORK 3, N. Y.

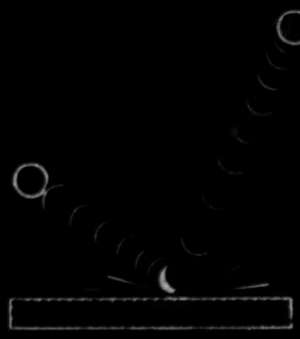
LIGHT
WEIGHT



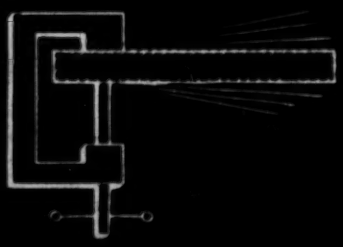
UNUSUAL
STRENGTH



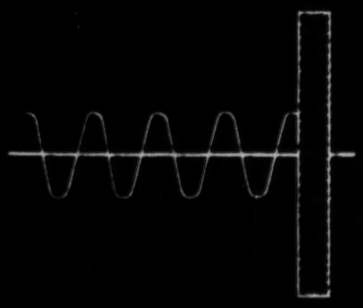
RESISTANCE TO
CORROSION



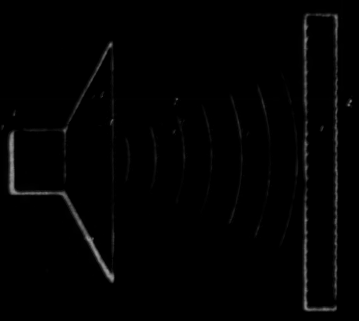
RESISTANCE TO
IMPACT



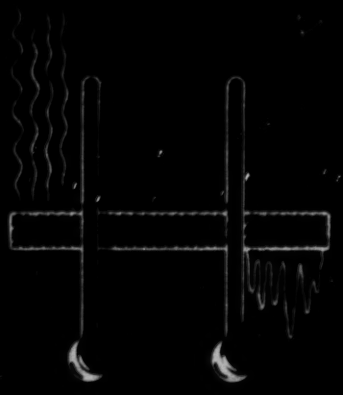
WITHSTANDS
VIBRATION



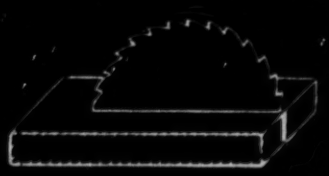
GOOD
INSULATOR



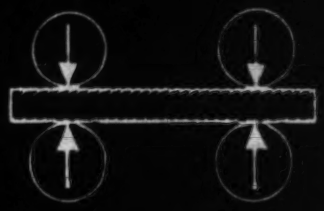
REDUCES
NOISE



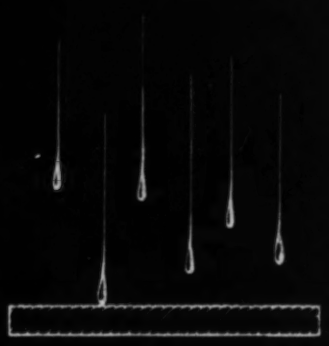
RESISTANCE TO
TEMPERATURE EXTREMES



FABRICATES EASILY,
ACCURATELY



RESISTANCE TO COMPRESSION



RESISTANCE TO MOISTURE

WEARS SLOWLY, EVENLY

CAN MICARTA'S UNUSUAL PROPERTIES SOLVE A PROBLEM FOR YOU?

Look into MICARTA's long list of serviceable qualities for practical ways to solve product design and production problems.

Pound for pound its compressive strength is greater than that of structural steel. It weighs only half as much as aluminum. MICARTA's unique resilience lets it absorb repeated shock and vibration without effect. In below zero temperature its tensile strength increases. In high temperatures its impact strength becomes even greater. MICARTA® fights corrosion . . . repels moisture. It's an excellent insulator.

MICARTA's remarkable properties have led to thousands of profitable applications in every major industry. How can this wonder-working material serve you? For complete information simply use the coupon below.

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AVIATION: Pulleys, instrument panels, structural members
MARINE: Propeller shaft bearings, bushings, piston rings
STEEL: Roll-neck bearings, hold down and upcoiler rolls
TEXTILE: Spinning buckets, shuttles, spools, bobbins, gears
CHEMICAL: Bubble caps, plating barrels, tubing, valve blocks
ELECTRICAL: Coil forms, terminal blocks, panels, name plates

YOU CAN BE SURE...IF IT'S Westinghouse

Westinghouse Electric Corporation
Micarta Division
Trafford, Pa.

Attention: L. A. Pedley
Sir: (Please check one)

☐ Please have your representative call
☐ Please send me complete facts on Micarta

Name_____ Company_____

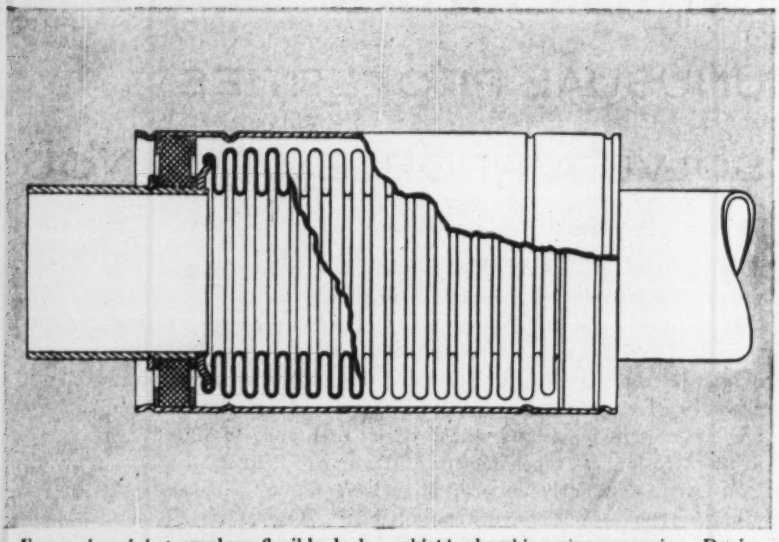
Address_____

City_____ Zone_____ State_____

ME-11-54

micarta® IS BASIC

How To Provide For Thermal Expansion With Bellows Devices



Expansion joint employs flexible, leakproof bellows to compensate for rapid thermal changes accompanying heating cycle in baseboard radiation systems. Bellows is free to move within protective shield, absorbing pipe expansion. Device eliminates source of common complaints arising from noise produced by expanding pipes grating against floor and wall timbers.

One of the simplest ways of providing for thermal expansion and contraction in fluid systems is through bellows devices incorporated in the original design.

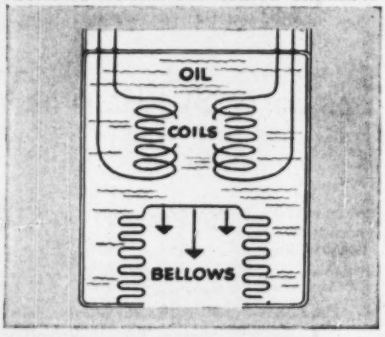
Where heating and cooling of fluids would ordinarily add unwanted stresses or even result in buckling or failure of members, the presence of a leak proof, flexible bellows properly located in the system compensates for dimensional changes. In addition, bellows flexibility permits a certain degree of misalignment to be tolerated without difficulty.

This latter factor can sometimes represent important savings in production since the need for time consuming, precise, "lining up" of elements is eliminated.

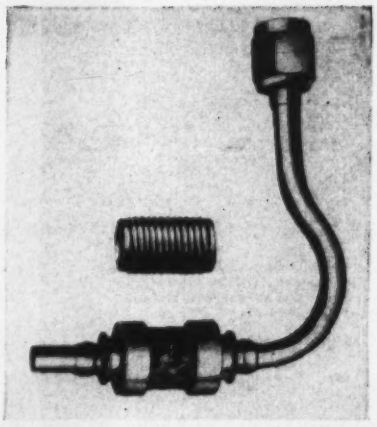
New Expansion Joint employing bellows as the flexible element solved a serious problem for manufacturers of baseboard radiation systems. Developed by the Clifford Manufacturing Company, the bellows joint takes up the expansion and contraction of the pipes with the heating cycle and eliminates the objectionable noises that result from pipes grating against floor and wall timbers.

Flexible Jet Manifold Assembly utilizing a stainless steel bellows as the flexible element solves a high temperature problem for jet engine manufacturers. Two benefits result: dimensional changes are compensated and easy, leakproof assembly of flare fittings can be made without concern for a small degree of misalignment. The protective metal braid and high strength stainless steel bellows make a mechanically rugged joint. Pressure rating is 1000 psi.

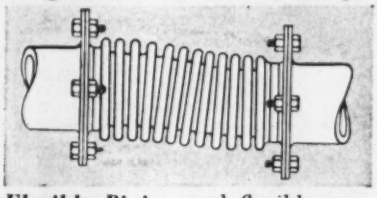
Hermetically Sealed Aircraft Transformers employ a built-in bellows within the sealed chamber



to compensate for expansion and contraction of the oil fill with temperature changes. The bellows thus prevents the development of high pressures within the unit and at the same time maintains a leakproof hermetic seal.



Flexible manifold assembly is designed around a stainless steel bellows for high temperature and anti-corrosion service. Flexibility of bellows simplifies alignment, permits easy, leakproof assembly of flare fittings and allows for thermal changes.

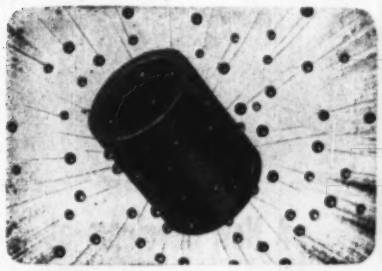


Flexible Piping and flexible connectors are other applications where bellows allow for thermal expansion and mechanical displacement. In high temperature piping systems for example, bellows connectors absorb expansion and contraction and permit lateral motion of pipe supports with respect to one another. In aircraft applications, flexible bellows connectors are employed in hot air de-icing systems where flexing of the wings requires equivalent flexing of the ducts.

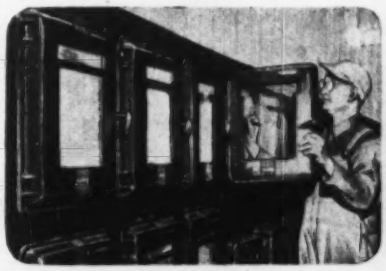
Your Design Problem involving thermal compensation or mechanical misalignment may be solved with a bellows device. Clifford will be glad to offer engineering help. Simply sketch the controlling dimensions and specify the service conditions. We will help you arrive at a proper design and produce in quantity to your specifications.

Write: Clifford Manufacturing Company, 144 Grove Street, Waltham 54, Massachusetts. *Division of Standard-Thomson Corporation.* Sales offices in New York, Detroit, Chicago, Los Angeles and Waltham, Mass. 7.4.23

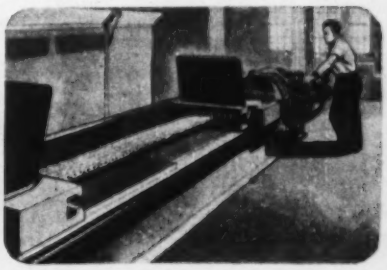
LINK-BELT RESEARCH AND ENGINEERING...WORKING FOR INDUSTRY



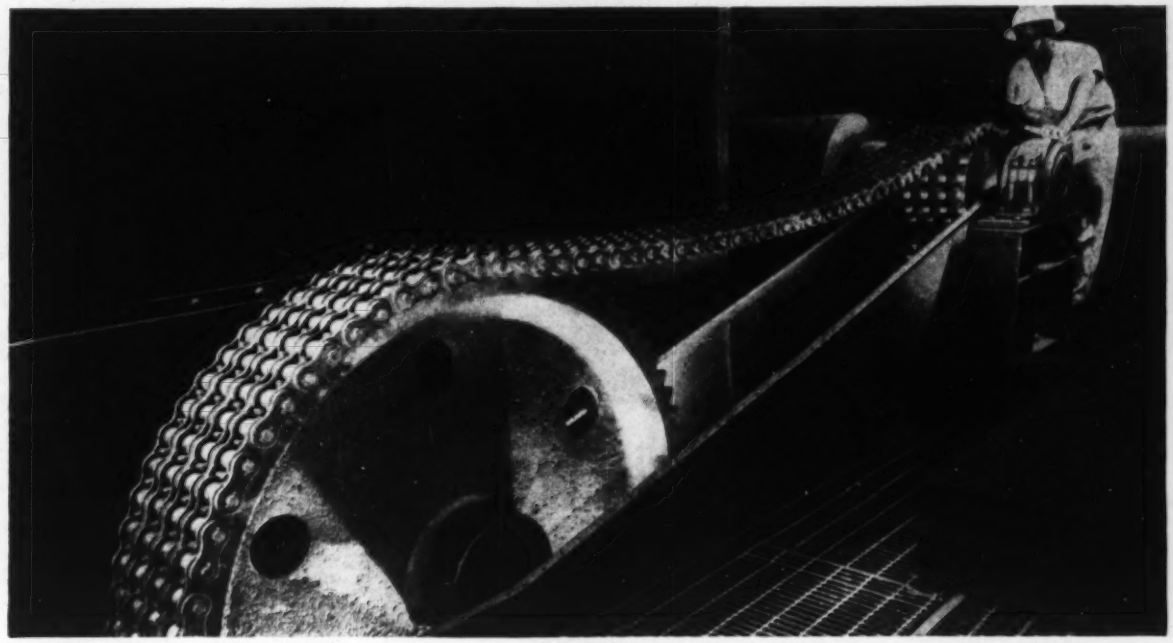
SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.



CLOSER HEAT-TREAT CONTROL, coupled with rigid testing, insures uniformity.



PRE-STRESSING of multiple-width chain provides uniform load distribution.



This Link-Belt Precision Steel Roller Chain drives a Link-Belt feeder built to handle 6000 long tons of ore per hour.

Link-Belt takes these extra steps in the manufacture of roller chain to give you

extra life in drives and conveyors

WHERE power must be transmitted unfailingly under demanding conditions of shock and impact, Link-Belt Precision Steel Roller Chain is the choice on an ever-increasing number of jobs like this huge iron ore feeder. Here is a driving and conveying medium that retains its better-than-98% efficiency throughout long years of service.

The reason: *Link-Belt builds extra life into every member of every link.* Added steps in manufacture . . . continuous testing and control . . . rigid inspection—all are combined to produce a chain that cuts power transmission and conveyor costs.

The complete Link-Belt line includes roller, silent, and all types of cast, combination, forged and fabricated steel chains. And chain, in turn, is only part of the extensive line of equipment Link-Belt builds for all industry's power transmission and materials handling needs.

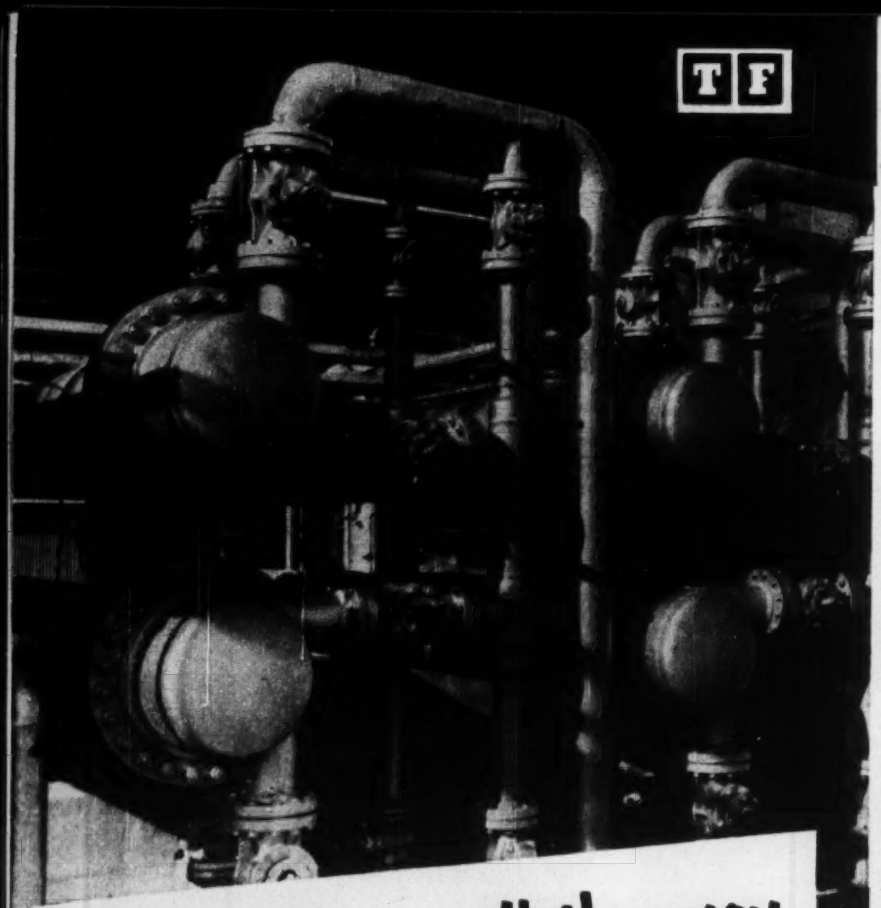
For an expert appraisal of your drive and conveying requirements, contact the Link-Belt office near you. And for facts on roller chain, write for 148-page Data Book 2457. LINK-BELT COMPANY, Dept. AV, 307 N. Michigan Ave., Chicago 1, Illinois.

13,878

LINK-BELT

One source . . . one responsibility for materials handling and power transmission machinery

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.



Taylor Forge all the way

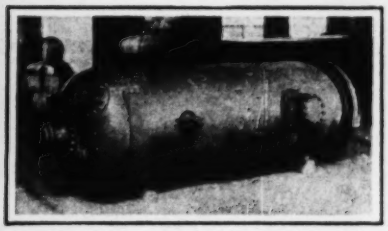
Throughout the power and process industries you will see hundreds of model installations like this where someone who wanted to be sure has specified Taylor Forge all the way through...WeldELLS,® flanges, welding necks, nozzles.

Whatever your needs—simple or complex—it will pay you to *use* all the way through, the products that have *led* all the way through.

See your Taylor Forge Distributor for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works: P.O. Box 485, Chicago 90, Illinois • Offices in all principal cities Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ontario, Canada



A New Development that's 37 Years Old

When you cut a hole in the shell of a pressure vessel you of course weaken it. But, how much?...or, to put it another way, how much reinforcement is necessary to make the shell surrounding an opening as strong as any other part of the shell?

In the old days of low pressure and over-sizing that hadn't been much of a problem. But when pressures began to climb fast (about 1915) it became a tough one.

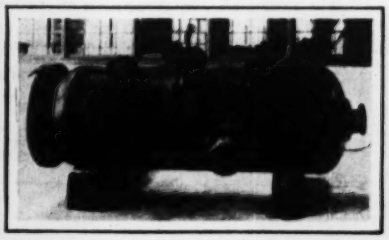
Taylor Forge had already begun to relish problems like this: had pioneered the forged steel flange; was playing a major part in the development of flange and piping standards. So it isn't at all surprising that Taylor Forge again came forward with the solution — the first seamless forged steel pressure vessel nozzles.

The research and testing that Taylor Forge put into designed pressure vessel outlets dates back to the riveted, sweep nozzles that are still giving safe, satisfactory service. But as riveting gave ground to welding, still more critical analyses were made to determine the exact requirements of nozzles designed for welding.

These many years of tests and studies were fully summed up in a paper entitled "Effects of Openings in Pressure Vessels" which was presented by the late J. Hall Taylor and Professor E. O. Waters at the June 1933 meeting of the ASME. It is still authoritative in this field.

Yes, a new idea that is 37 years old! So thoroughgoing was its first development—so critical the steps taken to maintain its leadership—that today Taylor Forge Seamless Nozzles and Welding Necks are the standards of the entire pressure vessel and piping industry.

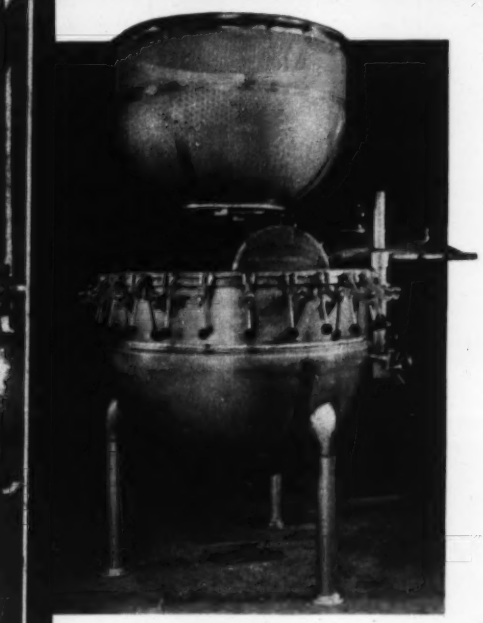
An episode in the story of Taylor Forge leadership in designed piping



New facts for your file on

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS



Perforated basket is easy to clean because it's made of Stainless Steel

● Hamilton Copper and Brass Works, a division of Brighton Copper Works, Inc., Cincinnati, Ohio, offers this perforated Stainless Steel basket with its line of steam-jacketed pressure cookers.

It's another application where Stainless Steel's smooth, dense surface dictates the use of this metal. There are no places for food particles to lodge and adhere even on a perforated basket like this. Consequently, cleanups are fast and easy and absolute sanitation is assured.

The kettle itself can be equipped with a Stainless Steel gate valve or flush-bottom valve, giving protection in another place where cleaning can be a problem. The adjustable leg flanges are Stainless Steel, too.

Now is the time to use the sales appeal of Stainless Steel

The many benefits of Stainless Steel make its use in your product a real "plus" from a sales standpoint. Its lasting good looks alone will often justify its use. And, along with this important advantage, goes exceptional resistance to corrosion and abrasion, ease of cleaning and low maintenance costs.

There's never been a better time to take advantage of the qualities of Stainless Steel. And when you do, be sure that perfected, service-tested USS Stainless Steel is used.

MANUFACTURED FROM USS STAINLESS STEEL UNITED STATES STEEL

Two valves dramatically demonstrate Stainless Steel's corrosion resistance

Both of the end gate valves shown above were in service in one of the pipe stills at a Gulf Coast refinery. The top valve, trimmed with Stainless Steel, is still in excellent condition after two years of service in light crude naphtha containing sulfur compounds.

The bottom valve, made of less durable materials, failed after only a year in the same kind of service.

Stainless Steel's ability to stand up under severe service conditions pays off every time. In many applications, it is far and away the most economical material you can use.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND · COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

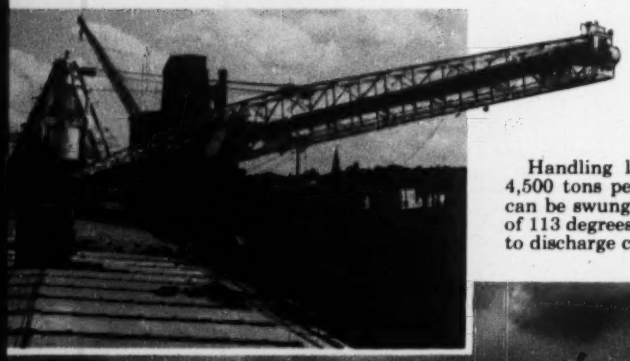
USS

UNITED STATES STEEL

USS HIGH STRENGTH STEELS
UNITED STATES STEEL
TWENTY YEARS OF PERFORMANCE

New facts for your file on

On self-unloading limestone carrier, USS TRI-TEN E Steel increases strength and reduces weight 18,000 lbs.



Built by Manitowoc Shipbuilding Inc., Manitowoc, Wis., the steamer *"John J. Boland"* is typical of the modern self-unloading cargo vessels now operating on the Great Lakes.

Handling limestone at the rate of 4,500 tons per hour, the 250 ft. boom can be swung through a horizontal arc of 113 degrees on each side of the vessel to discharge cargo, and can be elevated to an angle of 18 degrees. 50,000 lbs. of USS TRI-TEN E Steel were used in the boom and in the huge "A" frame which supports it.

Both these structures were designed by Robins Engineers, Division of Hewitt-Robins Incorporated.

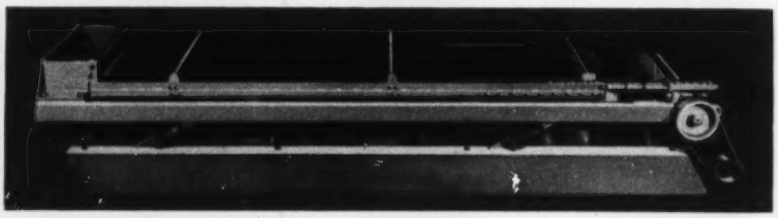
The choice of TRI-TEN E Steel, in plate and structural shape form, was dictated by the fact that the use of this high strength steel not only made it possible to substantially increase the strength and durability of these vital parts, but also resulted in saving between 8 to 10 tons of weight.

For many years, USS High Strength Steels have been successfully employed for special operating equipment such as the unloader shown here, where these "steels that do more" have proved economically superior by keeping weight at a minimum while at the same time insuring maximum strength and durability.

High endurance limit of USS COR-TEN Steel prolongs life of springs for vibrating screens

The high strength and superior atmospheric corrosion resistance of USS COR-TEN Steel are so widely recognized that it is not surprising that design engineers have sometimes overlooked another very important property of COR-TEN Steel, namely its high endurance limit—50% greater than that of carbon steel.

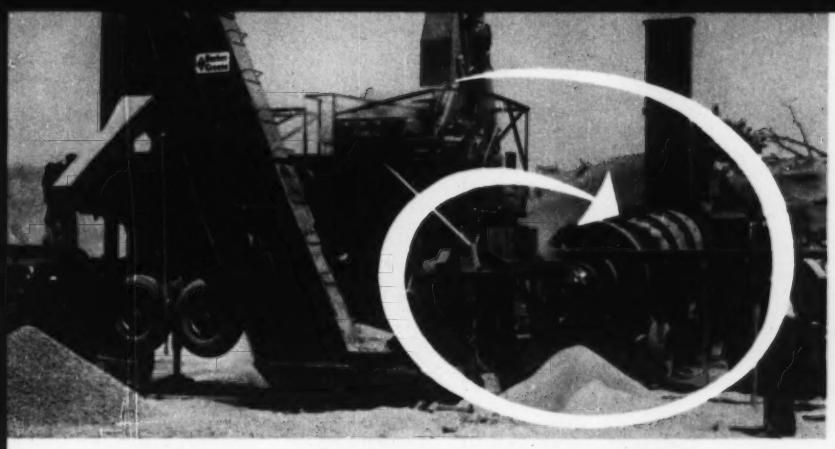
This property which gives USS COR-TEN Steel greater fatigue strength pays off in many applications where repeated loading, reversal of stress, or vibration are involved. For that reason, COR-TEN Steel has been used for several years to improve the performance of support and drive springs for Symons® vibrating screens made by Nordberg Mfg. Co. (illustrated here).



These springs of the laminated type are made of hot rolled strip. They vibrate at 750 to 800 cycles per minute —one million reversals of stress in about 20 hours. By replacing carbon steel with USS COR-TEN Steel, longer and more uniform service life has been obtained.

If you are building or using high speed machinery or other equipment that is subject to severe vibration stresses, it may be to your advantage to find out more about COR-TEN Steel.

USS HIGH STRENGTH STEELS



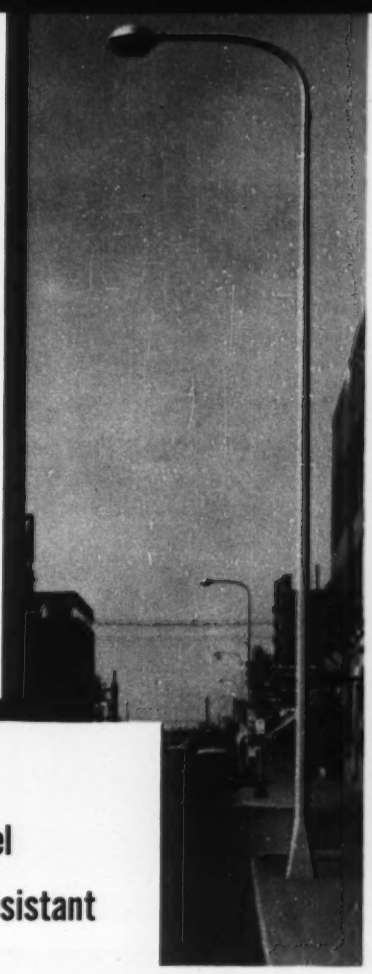
Asphalt plant dryer drum is built of USS MAN-TEN steel to increase resistance to abrasion and heat

Where bituminous roads are being built, Barber-Greene Asphalt Mixing Plants are a familiar sight. The model 845 plant shown here produces tar or asphalt road paving mixes at a rate in excess of 60 tons per hour.

In the dryer, which removes the moisture from the sand and stone used in the aggregate, temperatures run as high as 800°F. and abrasive action is severe. To meet these conditions, the Barber-Greene Co. of Aurora, Ill., builds the entire dryer drum of high strength USS MAN-TEN Steel. With this steel, which has one and a half times greater yield strength than carbon steel, they obtain in addition, greater abrasion resistance and greater resistance to impact and vibration—important qualities that help to prolong life and keep maintenance costs to a minimum.

For more than twenty years USS MAN-TEN Steel has been used to increase the durability of road building equipment of many types. In concrete mixers for example, where ability to withstand abrasion is highly desirable, it has found wide application in the mixing drums, mixing blades, charging hoppers and discharge chutes.

If you want to increase the working capacity of your equipment or give it extra stamina to keep it on the job, all at low cost, find out how readily USS MAN-TEN Steel can be incorporated in your designs, how easily it fabricates and how little it costs to use.



Street lighting standards made of USS MAN-TEN Steel are more rigid . . . more resistant to impact and vibration

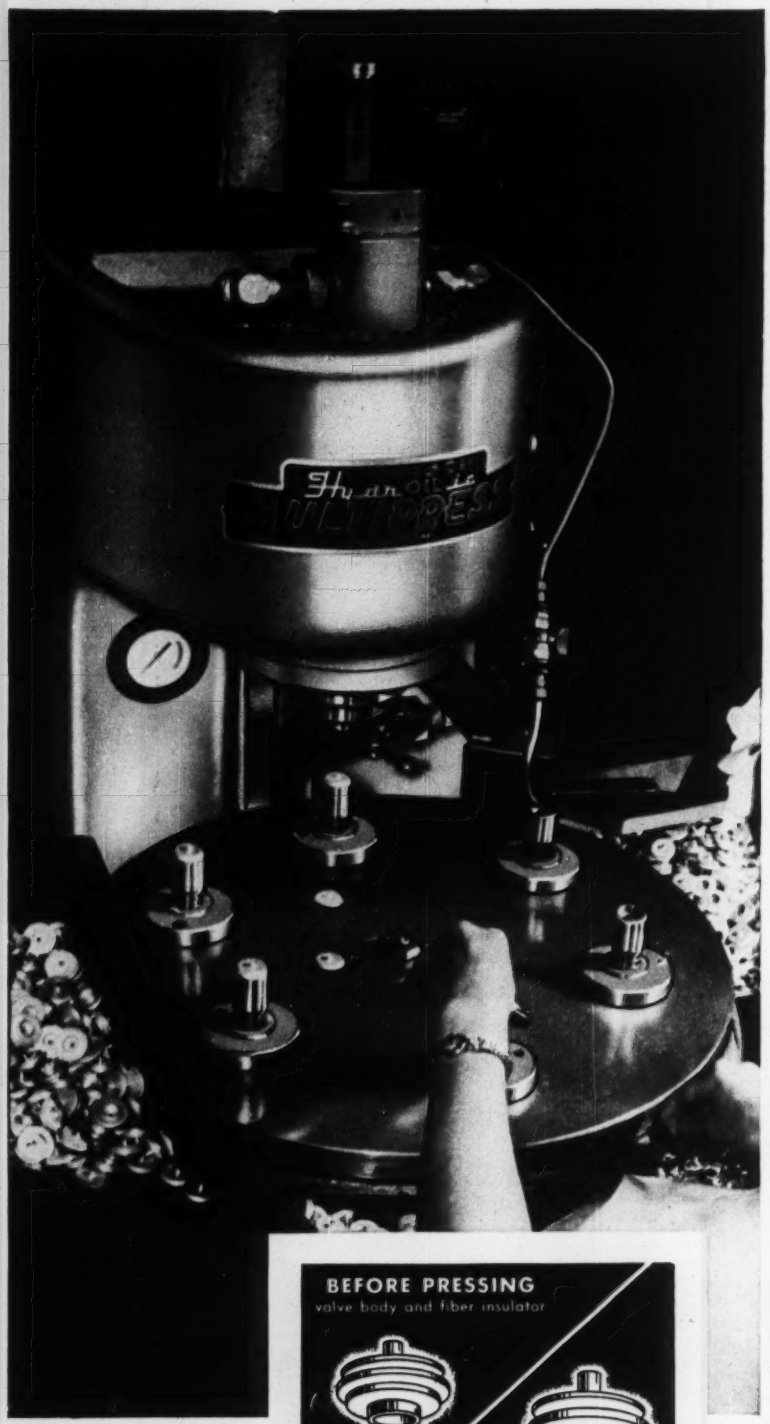
In their line of Octa-Tube Lighting Standards, engineers of Millerbernd Manufacturing Company, Winsted, Minnesota, have discovered a low cost way of obtaining maximum strength and durability with minimum weight.

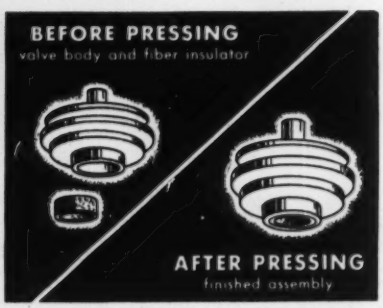
By using 11-gage USS MAN-TEN Steel, with its high strength and its atmospheric corrosion resistance equal to that of copper steel, in place of the usual 11-gage carbon steel, extra strength to resist wind and ice loading conditions was achieved . . . and proven in actual tests.

According to the manufacturer, "Lighting standards take quite a beating in ordinary use . . . impacts from car bumpers and street maintenance equipment, vibrations caused by heavy vehicles, and corrosion from street chemicals or industrial atmospheres. In MAN-TEN Steel, besides extra strength, we get an extra measure of resistance to these impacts, vibrations, and corrosive elements."

Two important factors affecting the choice of USS MAN-TEN were its ability to be cold-roll formed and its readiness to take finish preparations. MAN-TEN qualified highly on both counts.

For more than 15 years, the Millerbernd Manufacturing Company has used USS High Strength Steels in many of its products, resulting in lower costs and improved customer satisfaction. The *extra* qualities of these "steels that do more" are important selling points in this kind of equipment.





4 times faster with DENISON MULTIPRESS®

FROM 7 a minute to 30 a minute—by switching to Denison hydraulic Multipress.

Pressing fiber insulators into gas control-valve bodies was a slow process using an air cylinder method. Now, a 4-ton Multipress does it 300% faster. The reasons: Faster loading of parts, continuous operation on preset time cycles, automatic ejection of finished parts.

With Denison hydraulic Multipress, the operator simply loads insulators on a rotary Index Table. The Index Table carries the parts under the hydraulic ram. One smooth hydraulic stroke presses the insulator into the gas control-valve body.

Denison Multipress increases production on many types of jobs in the 1-to-75-ton pressure range. Ask for cost-cutting ideas and technical bulletins.

THE DENISON ENGINEERING COMPANY
1174 Dublin Road • Columbus 16, Ohio

DENISON hydrOILics

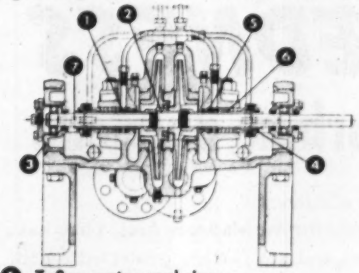
announcing...
the Goulds Fig. 3305 two-stage, opposed impeller pump for clear liquids. 5 sizes. Capacities to 1200 GPM. Heads to 1000 ft.

This new Goulds pump offers you 5 specific operating and maintenance advantages . . .

To reduce your liquid-handling costs through greater standardization, easier maintenance, and improved operating characteristics, Goulds engineers have developed the *new* Goulds Fig. 3305 two-stage, opposed impeller centrifugal pump. Here are the highlights—the result of 50 years concentration on industry's centrifugal pump needs.

1 High operating efficiency, low maintenance cost

The Fig. 3305 pump combines the seven features indicated on the sectional drawing below to contribute a quality of dependable service which adds up to true operating and maintenance economy.



1. Teflon water-seal rings.
2. Stainless steel impeller key.
3. Bearing housing sealed against moisture and dirt.
4. Cowl-type glands suitable for use with quenching liquids.
5. Renewable stuffing box bushings.
6. Die-formed stuffing box packing.
7. Corrosion-resistant gland bolts.

2 Reduces your spare parts inventory

Only two shaft and rotating parts assemblies provide for 5 pump sizes and 10 pump combinations. This means a remarkable range of parts interchangeability which you will find detailed on page 7 of the descriptive bulletin. Furthermore, most of the components of the Fig. 3305 shaft and rotating assemblies are interchangeable in the Fig. 3405 single-stage, double-suction pump which has won industry-wide acceptance in the year since it was introduced.

This high degree of standardization helps materially to reduce spare parts inventories. It also gives you great flexibility in adapting your Fig. 3305 pump to changing field requirements.

3 Saves space

The short bearing span of Fig. 3305 pumps means considerable saving in floor space—as much as 50% in some comparisons with conventional designs of comparable capacity and head.

4 Stuffing box to match your requirements

You can choose either a conventional stuffing box with gland or a mechanical seal, according to your need. And you can easily change from one to the other at any time.

5 Simple to change rotation

A patented locking device makes it easy to change the rotation of this pump from right-hand to left-hand or vice versa *in the field and without additional parts.*

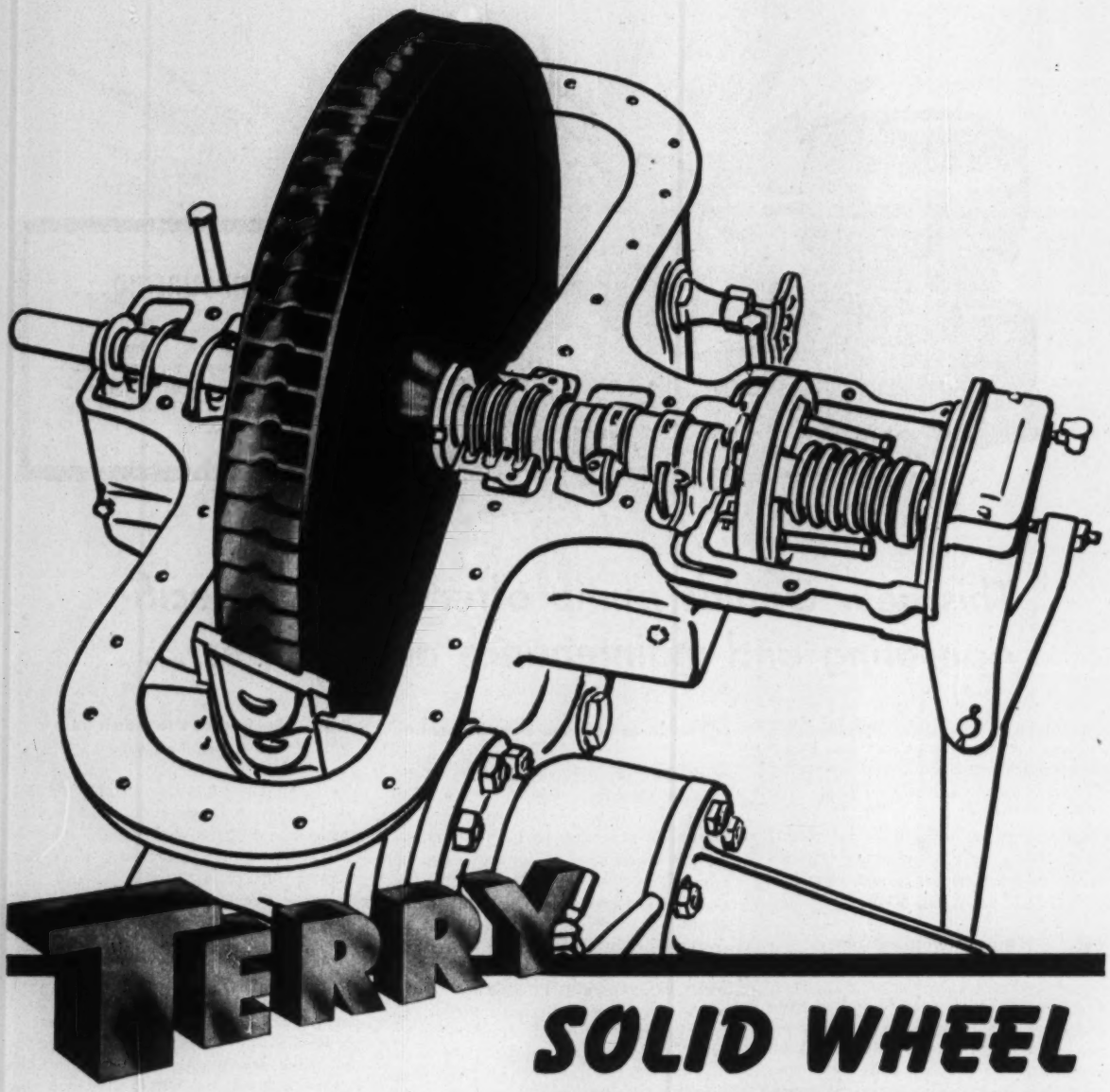
Before you select another pump for handling clear liquids at rates up to 1200 GPM and heads to 1000 ft., be sure you have the detailed cost-advantage story of Goulds new Fig. 3305 pump. We'll send you descriptive bulletin—promptly on request.

MEMBER

Get the complete story—This 12-page illustrated Bulletin No. 722.6, covers the new Goulds Fig. 3305 pump completely. It gives specifications, interchangeability tables, performance curves, dimensions.

Goulds PUMPS INC. Seneca Falls New York

ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • TULSA



SOLID WHEEL RUGGEDNESS

is your turbine dividend

The rugged construction and fool-proof design of a Terry solid-wheel turbine can save you money by keeping maintenance costs to a minimum. Usually only taken down for routine inspection, any repairs that must be made are of relatively simple nature, and cost of replacement parts is small.

The rotor of the turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which might occur would not materially affect horsepower or efficiency.

It is impossible for the blades to foul. They have large clearances and are further protected by the projecting rims of the sides of the wheel. As the side clearances are also very large, end play can do no harm.

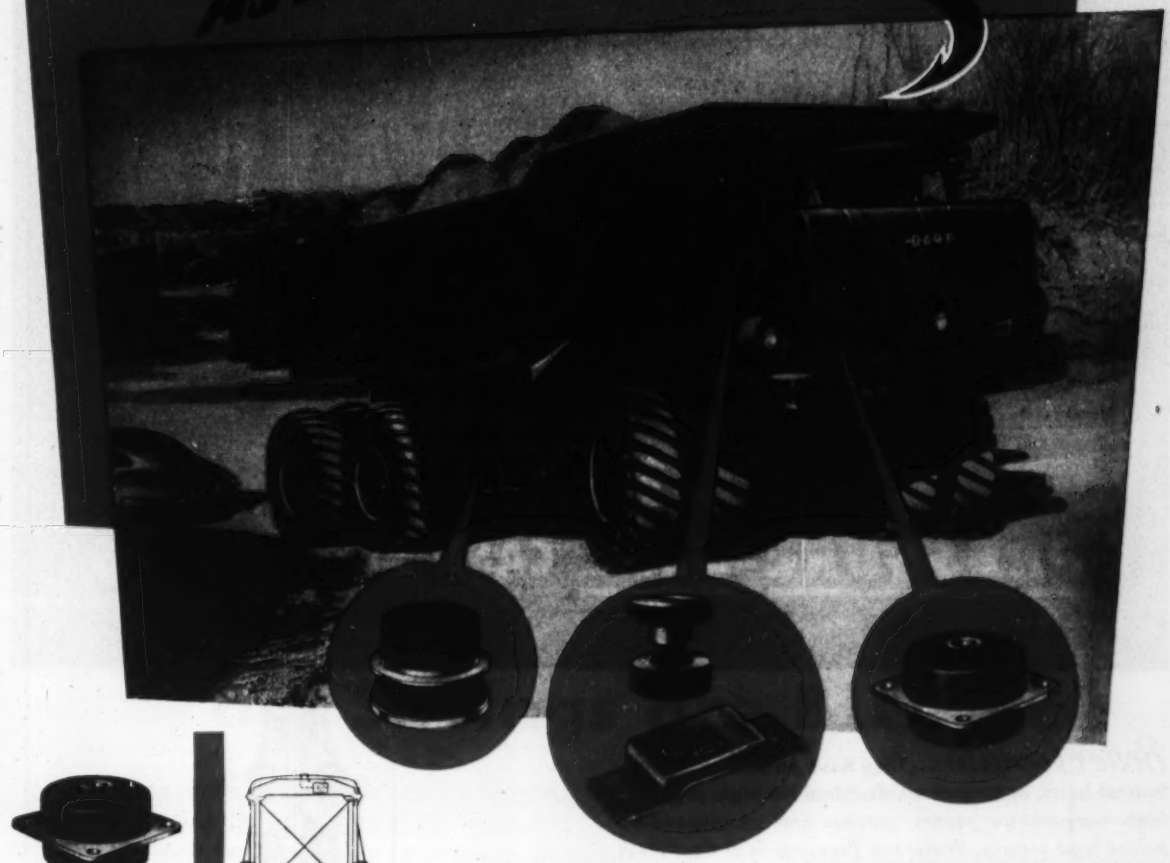
The Terry solid-wheel turbine is an extremely reliable piece of equipment—why not write for complete details today? Ask for a copy of Bulletin S-116.

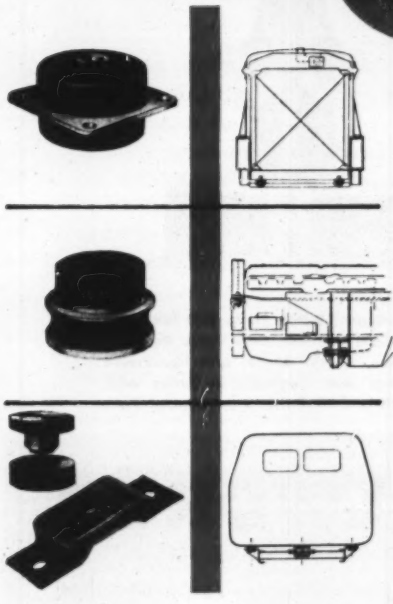
TT-1198

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

LORD

Bonded-Rubber Mountings ..
As Rugged As This





The world's largest "off-the-road" truck, Model 60 Dart, hauls 60 tons of copper ore from the huge shovels in the pits of The Bagdad Copper Mines of Bagdad, Arizona to the mine rim over tortuous, twisting, climbing roadways impossible for any other means of transportation. Contributing to the desired performance of this mammoth vehicle, Lord Bonded-Rubber Mountings cushion the twin radiators against vibration and shock, thus protecting the vital cooling system and reducing maintenance costs.

The two 350 hp. diesel engines and transmission assemblies are protected from the shocks of rough going by Lord Mountings . . . these same mountings provide a barrier between damaging engine vibration and the truck itself. To complete the job Lord Mountings protect the cab.

As rugged as the products they protect, Lord Bonded-Rubber Parts are used every day to improve the performance of industrial products large and small . . . Let us work with you.

DETROIT 2, MICHIGAN 311 Curtis Building
LOS ANGELES 28, CALIFORNIA 7046 Hollywood Blvd.
CHICAGO 11, ILLINOIS 520 N. Michigan Ave.
CLEVELAND 15, OHIO 811 Hanna Building
PHILADELPHIA 7, PENNSYLVANIA 725 Widener Building
NEW YORK 20, NEW YORK 630 Fifth Avenue Rockefeller Center
DALLAS, TEXAS 313 Fidelity Union Life Building
DAYTON 2, OHIO 410 West First Street

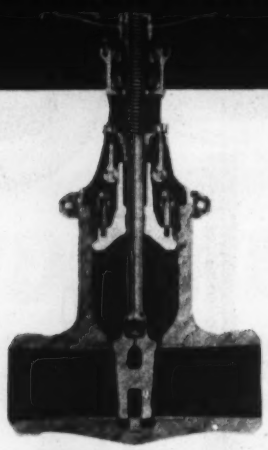
LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

Headquarters for
VIBRATION CONTROL

WALWORTH

PRESSURE-SEAL CAST STEEL VALVES



Better because ... **They have no bonnet flanges, bonnet bolts, or bonnet welds. Ideal for high-pressure, high-temperature steam service and corresponding boiler feed service, Walworth Pressure-Seal Cast Steel Valves weigh less, and take up less space than the flanged bonnet type of valves used for similar services.**

These are a few of the important advantages made possible by the design of Walworth *Pressure-Seal* Cast Steel Valves. Internal line pressure is utilized within the bonnet to maintain a tight, leakproof, body-to-bonnet connection under all normal operating conditions. The higher the pressure, the tighter the seal.

Ask for your copy of Walworth Circular 143. It gives detailed information, including sizes, dimensions, and specifications for all Walworth Pressure-Seal Cast Steel Valves.

Cross section of 8-inch Series 900 Walworth Pressure-Seal Cast Steel Gate Valve. Pressure-Seal Globe, Check, Angle, and Non-Return Valves are also available in Series 600, 900, 1500 and 2500 in a wide range of sizes.

WALWORTH

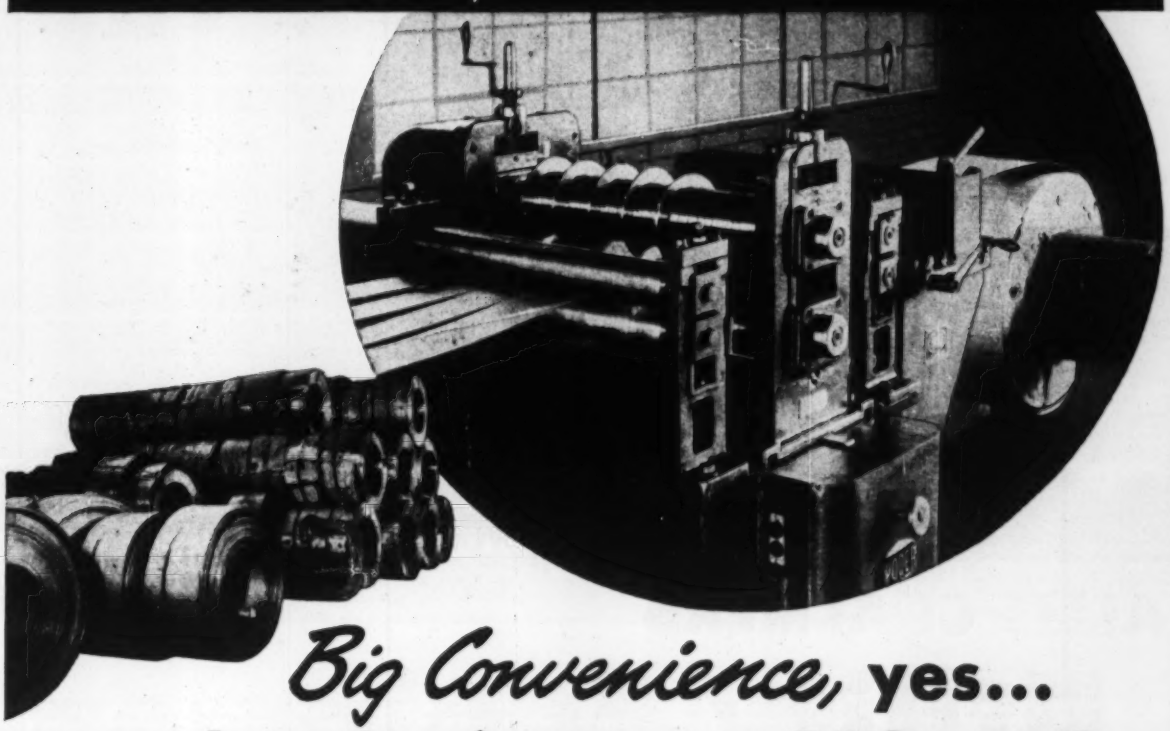
Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

YODER *Multiple Rotary* SLITTERS



Big Convenience, yes... but Savings are BIG, too!

Ask any owner of a Yoder slitter. He is apt to mention first the big *convenience* of being able at all times to supply his own needs in slit strands, from a relatively small stock of standard width coils. He no longer has to worry about ordering slit-to-width stock far in advance in order to anticipate production needs; changing production schedules he takes in his stride because he can meet unexpected needs for special widths on a few hours' notice. Since he is independent of outside slitting service he can buy his strip supply wherever he can get the best quality, price and delivery.

All of these conveniences may make him forget to mention the direct saving in dollars and cents which in most instances are big enough to pay for the slitter installation in a year or two, often even less.

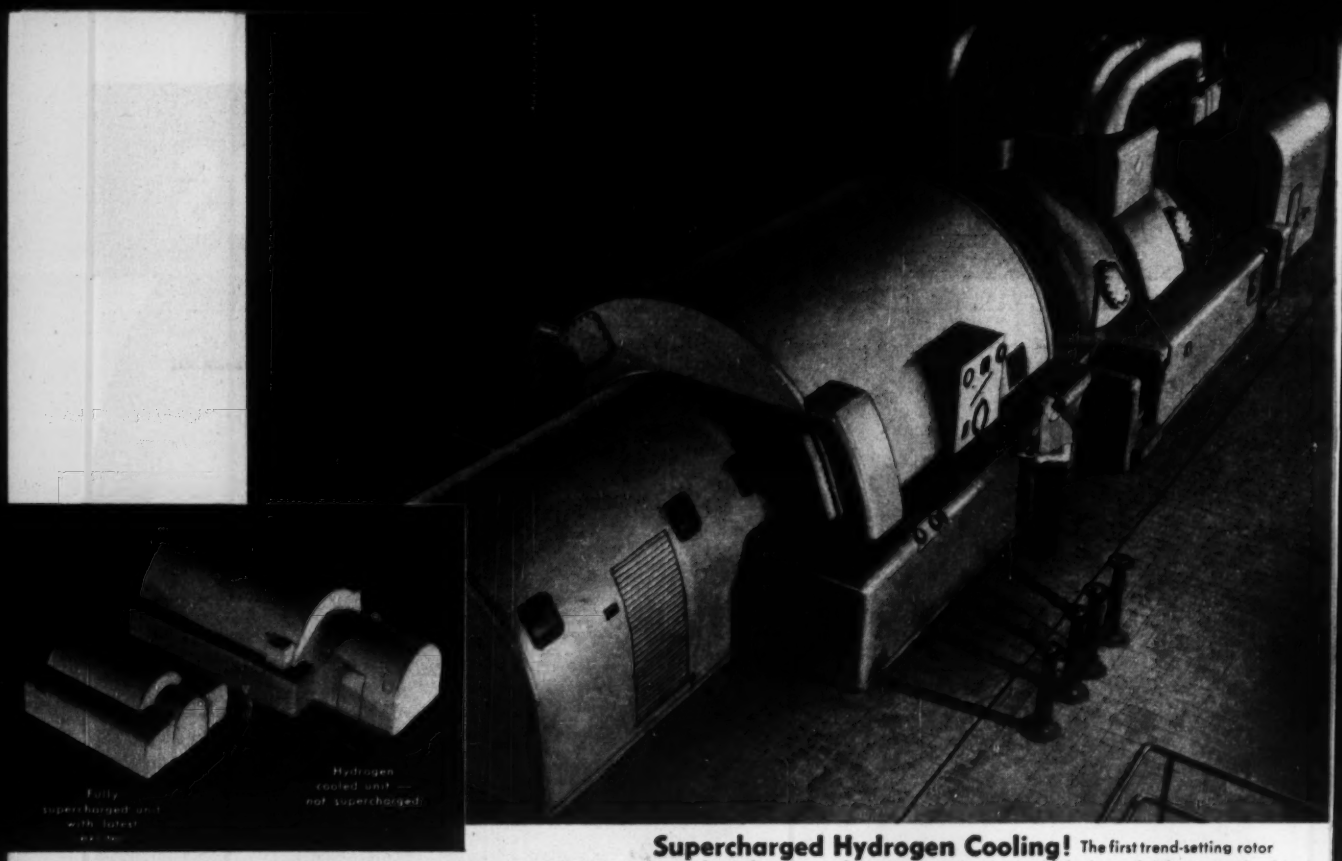
The Yoder Slitter Book is a treatise on the mechanics as well as the economics of slitter operation, with time studies, cost analyses, coil handling, scrap disposal, and other useful data. It's yours for the asking.

THE YODER COMPANY
5549 Walworth Ave. • Cleveland 3, Ohio

Complete Production Lines

- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

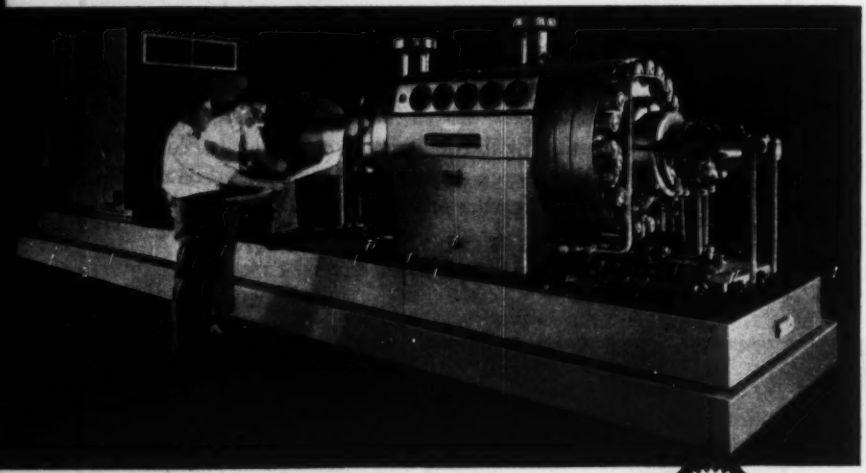


Supercharged Hydrogen Cooling! The first trend-setting rotor supercharged steam turbine generator unit established availability record of 99.86% during first two calendar years. Models of generators at left clearly show relative size reduction obtainable with fully supercharged cooling.

ALLIS-CHALMERS

Utility Equipment

Here are just a few of the many developments introduced by Allis-Chalmers in the last few years for the fast-moving utility industry. For information on any of these items call your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.



Developments in Motors and Pumps for Boiler Feed Service

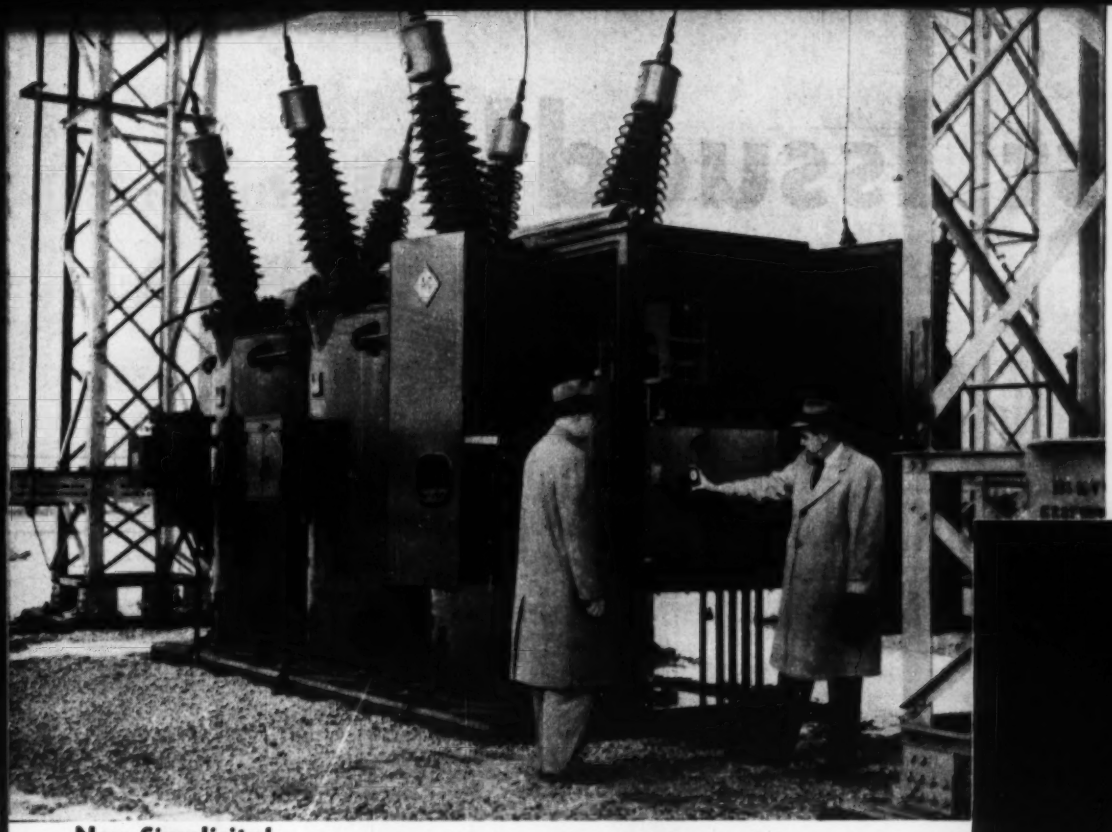
Redesigned Two-Pole Motor — Top air intake and discharge *plus* spiral stator core ventilation are now featured. Top air discharge permits closer mounting of motors. Spiral ventilation assures even internal cooling... helps reduce noise. In addition, motor has modern appearance and new capsule-type bearings are provided.

Latest Boiler Feed Pump — Recent refinements include simplified oil piping arrangement and lagging around barrel to permit insulation of barrel and provide improved appearance. Pump is barrel-type for high efficiency, high pressure service. Single stage back-to-back impellers balance axial forces without use of balancing drum. Double volute casings balance radial forces.

Pneu-Draulic is an Allis-Chalmers trademark.

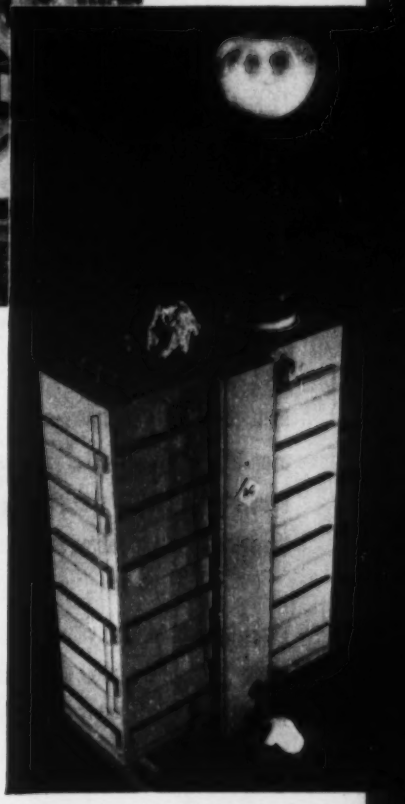
A-C ALLIS-CHALMERS

ALLIS-

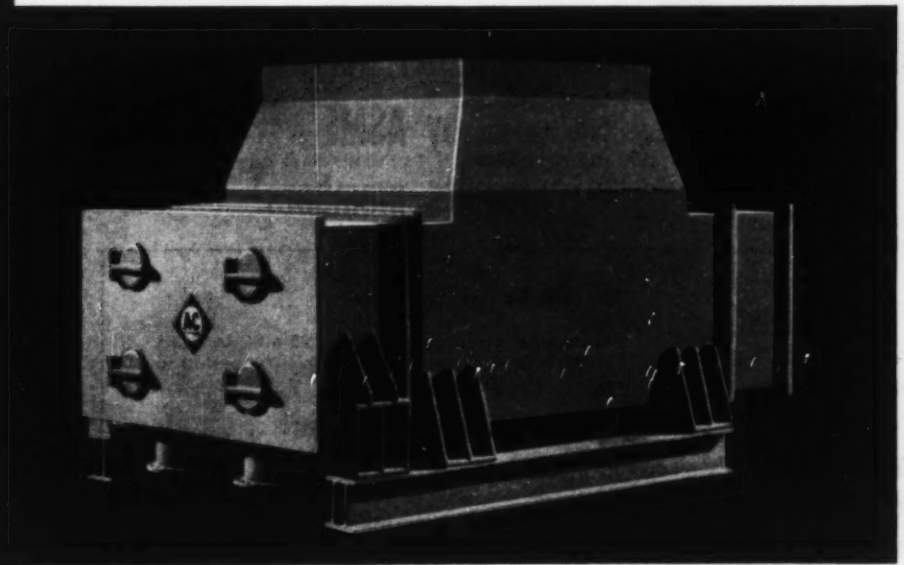


New Simplicity! *Pneu-Draulic* operating mechanism for breakers utilizes hydraulic principle instead of air. This reduces dirt and moisture hazards, adds reliability to breakers. These 115-kv breakers with *Pneu-Draulic* operators have been in service more than a year.

Developments



A Look At Tomorrow!
This 5000-kva power transformer, designed for 600 or 800-kv service, was built to help advance engineering knowledge toward possible future requirements.



Space-Saving Condenser! Latest 100,000-square-foot condenser, now being built, illustrates trend to rectangular shape, which permits savings in plant construction cost. Model allows unusual view of unit. This condenser features multi-steam path design for low "terminal difference," high condensate temperature and low absolute pressure.

A-4484

CHALMERS

Just Issued!

The New 1955 MECHANICAL CATALOG

Coming your way, designed for ease in recognition is your new 1955 MECHANICAL CATALOG. More than 3,500 manufacturers cooperated in bringing you up-to-the-minute information on 6,000 products in over 50,000 listings, plus 348 pages of illustrated details to provide the specific data you need to guide the selection of engineered products.

Cross indexed to save valuable time in locating suppliers of anything from absorbers to zinc oxides, MECHANICAL CATALOG has proved its usefulness to engineers since 1911.

If you haven't already reserved your copy, do so now, the supply is limited.

Another service by ASME for its members!

Mr. C. E. Davies, Secretary

Please send me a copy of the 1955 MECHANICAL CATALOG. I have not previously requested a copy of the 1955 edition.

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THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th Street, New York 18, N. Y.

See why
FAST'S Couplings
are your wisest buy

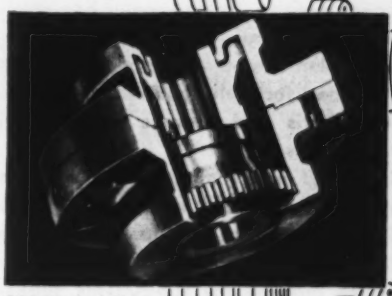
LESS DOWN-TIME. Industry finds that Fast's Couplings, the original gear type coupling, give trouble-free performance. They save on maintenance. Save money (often thousands of dollars in production losses) year in, year out, because there is no down-time due to breakage . . . no expense of replacing perishable parts.

LOWEST COST PER YEAR because Fast's Couplings usually outlast the equipment they connect. Many Fast's Couplings are still in use after 30 years. Why? Because they are ruggedly constructed of the sturdiest, most practical materials . . . all steel in construction, unique in design.

FREE ENGINEERING SERVICE. The same "Know-how" that goes into the manufacture of famous Fast's Couplings . . . that has resulted in over three-fourths of a million successful installations . . . applies to its extensive engineering service. 35 years of experience in developing the most satisfactory materials and designs, means our staff is well prepared to give you the most effective and cost-saving solutions to your coupling problems. Just outline and send them to Koppers for assistance. And send for free catalog. Just mail the coupon below.

Fast's Coupling installation in a modern power plant.

Close-up of Fast's Coupling, linking power to industrial fan.



Cutaway view of typical Fast's Coupling. Note unique design.

THE ORIGINAL

FAST'S Couplings

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METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE, MD. This Koppers Division also supplies industry with American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators, Aeromaster Fans and Gas Apparatus.
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Gentlemen: Send me a Free, Fast's Catalog giving detailed descriptions, engineering drawings, capacity tables and photographs.

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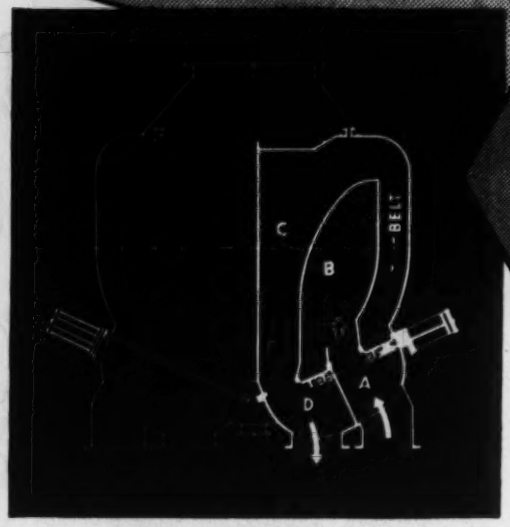
C. H. WHEELER "SELF CLEANING" PATENTED REVERSE FLOW STEAM CONDENSER



REVERSE FLOW

Illustrated is the C. H. Wheeler tandem arrangement in which both sluice gates operate on a single stem. In this divided water box condenser, water enters chamber A with left hand port open and flows in through pass B, out through pass C and through left hand port D. To reverse the flow, gates move to left, closing the left hand ports and opening the right hand ports of chambers A & D. Water now flows through belt, in through C and out through B and right hand port of D. The same method applies, of course, to a non-divided water box design.

No Shutdown — No Vacuum Loss for Tube Cleaning

The C. H. Wheeler Patented Reverse Flow design makes either single or divided water box steam condensers self-cleaning. These condensers are saving power plants countless hours of downtime and reduced load formerly required for manual removal of debris and organic growth from clogged tube sheets.

"Self-Cleaning" is accomplished by a set of sluice gates built integrally into C. H. Wheeler Surface Condensers which may be electrically or hydraulically operated to reverse the flow of cooling water through the tubes. This sudden flushing-in-reverse removes all debris and crustaceous matter and carries it out the discharge while carrying full load on the turbine and without reducing water flow. Also, the quick change in temperature shocks and dislodges marine growth.

Depending on condition of the cooling water, C. H. Wheeler Reverse Flow condensers have gone two years and longer before requiring cleaning. A typical field report tells of regaining a half-inch loss of vacuum (due to fouled tubes and tube sheets) five minutes after reversing the flow of condenser cooling water.

C. H. Wheeler custom - designs Reverse - Flow Condensers to suit any installation, arranging sluice gates and nozzles at top or bottom of water box and at any angle desired. Call a C. H. Wheeler representative to go over your specifications. It will mean years of substantial savings.

(BULLETIN 410 mailed on request)

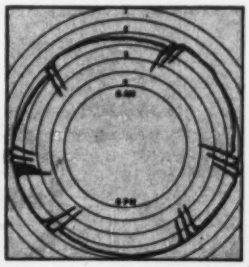
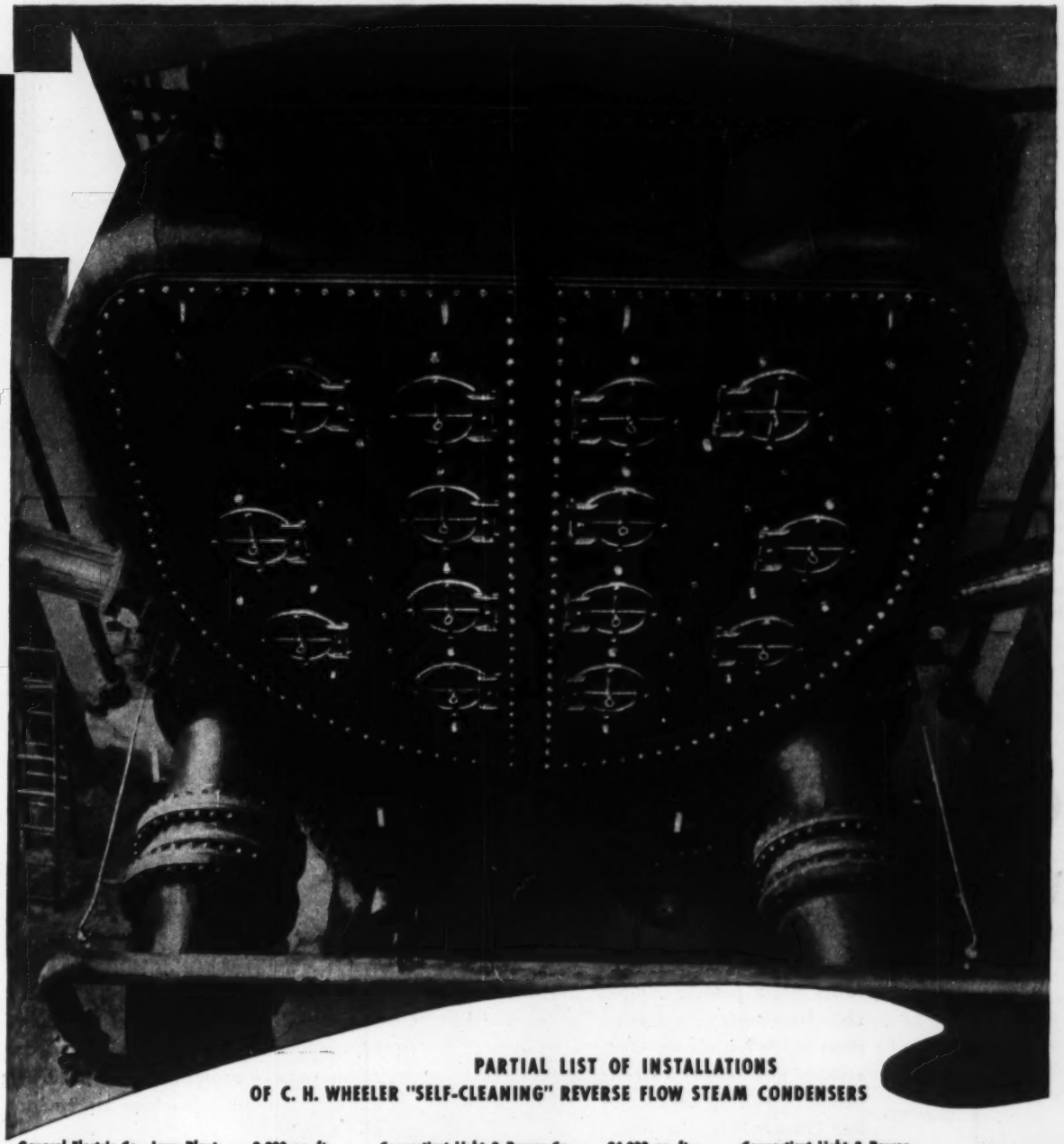


Chart shows typical cycle of vacuum and effect of reverse flow in a C. H. Wheeler Patented Self-Cleaning Reverse Flow Condenser. Note that because of 100% back flushing, the loss of vacuum during the reverse flow cycle is negligible.

SEE IT AT THE POWER SHOW — PHILADELPHIA, DECEMBER 2, 3, 4, 6, 7



PARTIAL LIST OF INSTALLATIONS
OF C. H. WHEELER "SELF-CLEANING" REVERSE FLOW STEAM CONDENSERS

General Electric Co., Lynn Plant . . 8,900 sq. ft.
General Electric Co., Lynn Plant . . 12,500 sq. ft.
Keystone Steel & Wire, Peoria . . 10,000 sq. ft.
Virginian Railways, W. Va. . . . . 15,000 sq. ft.
City of Wyandotte, Mich. . . . . 12,000 sq. ft.
City of Kansas City, Kansas . . . 32,500 sq. ft.
New Bedford Gas & Edison Light, New Bedford, Mass. . . . 16,500 sq. ft.
New Bedford Gas & Edison Light . 25,000 sq. ft.
Connecticut Light & Power Co., Montville Station . . . . . 24,000 sq. ft.
Connecticut Light & Power Co. . . 24,000 sq. ft.
Connecticut Light & Power Co. Devon Station . . . . . 50,000 sq. ft.
Georgia Power Co., Atkinson Station, 47,000 sq. ft.
Alabama Power Co , Units 1 & 2 Gadsden Station . . . . . 47,000 sq. ft.
City of Holland, Michigan . . . . . 13,000 sq. ft.
South Carolina Electric & Gas, Unit #1 Urquhart Station . 45,000 sq. ft.
South Carolina Electric & Gas, Unit #2 Urquhart Station . 45,000 sq. ft.
Connecticut Light & Power, Montville Station . . . . . 55,000 sq. ft.
Monongahela Power Company, Albright #3 . . . . . 65,000 sq. ft.
Georgia Power Company, Hammond Station, Units 1-2-3, 74,000 sq. ft.
City of Jacksonville, Fla., Southside Station . . . . . 40,000 sq. ft.
Tallyrand Station . . . . . 40,000 sq. ft.

C. H. WHEELER *of Philadelphia*

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

The Dana Warp Mills took advantage of Life-Line Gearmotors' compactness and operating efficiency. Shown is a Life-Line Gearmotor driving a delivery roll on a slasher.

Close-Quarter Servicing No Problem when your drive is a Westinghouse Gearmotor

Powering equipment at the Dana Warp Mills meant putting compact and dependable drive units into cramped quarters. To meet space limitations, designers carefully selected gearmotors with minimum size and definite servicing advantages . . . they specified Life-Line Gearmotors.

Integral design of Life-Line Gearmotors provides maximum saving in space and means no intricate coupling or alignment problems.

Inspection and servicing of Life-Line Gearmotors is simple. Sight gauges on both sides of gear case enable quick detection of oil level. The gear case is split horizontally and by removing a few bolts, the gear cover can be lifted clear of the unit. This simple operation makes all working parts accessible without draining oil or disturbing the unit mounting. Machine alignment remains true.

Life-Line* motor features and tough, precision-made Westinghouse gears combine to give Life-Line Gearmotors lasting stamina, even on the most rugged jobs.

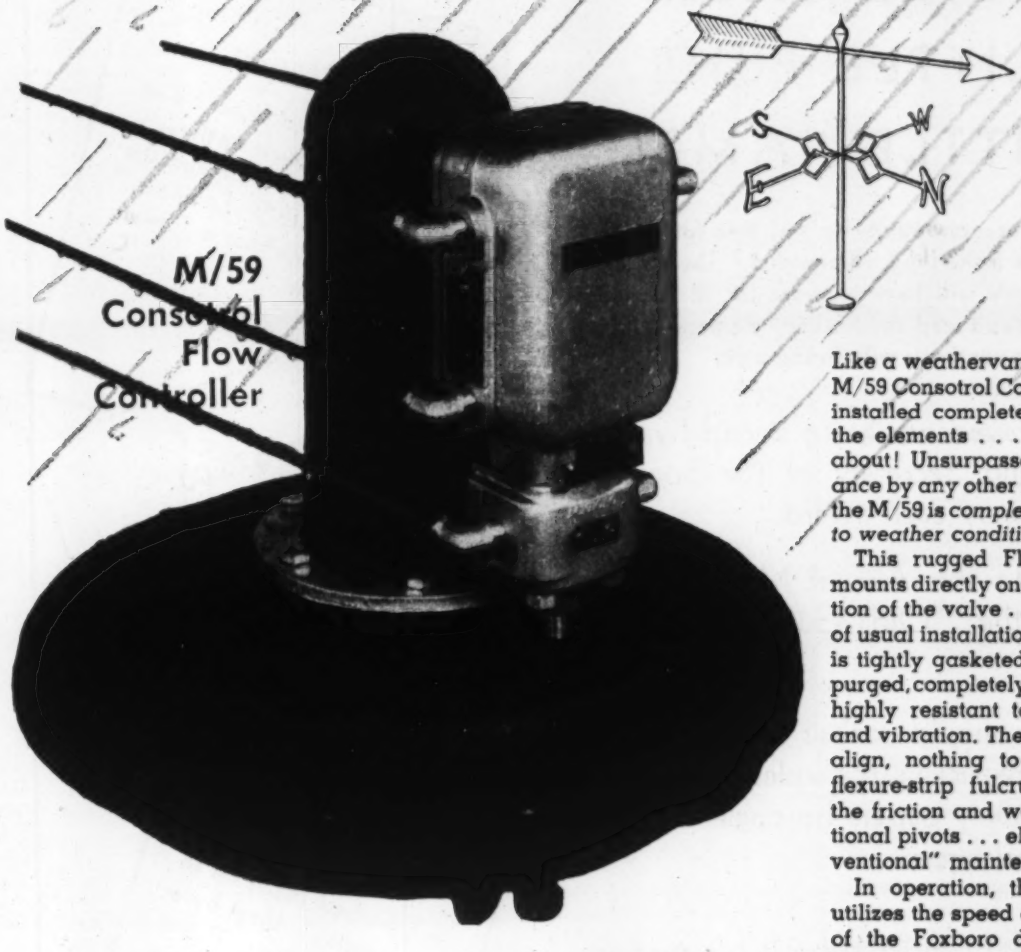
For detailed information, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07323

*Trade-Mark

YOU CAN BE SURE... IF IT'S Westinghouse

This Controller

requires no more attention than a weathervane!



Like a weathervane, the Foxboro M/59 Consotrol Controller can be installed completely exposed to the elements . . . and forgotten about! Unsurpassed in performance by any other flow controller, the M/59 is *completely indifferent to weather conditions.*

This rugged Flow Controller mounts directly on the air connection of the valve . . . at a fraction of usual installation cost. Its case is tightly gasketed, continuously purged, completely weatherproof, highly resistant to dust, fumes, and vibration. There's nothing to align, nothing to wear out. A flexure-strip fulcrum eliminates the friction and wear of conventional pivots . . . eliminates "conventional" maintenance.

In operation, the M/59 fully utilizes the speed and sensitivity of the Foxboro d/p Cell Flow Transmitter . . . does away with transmission lag . . . gives fastest recovery from process upsets. For the *complete* story, write today for Bulletin 470.

"Live-Balance" Control on any fluid with any size valve motor.

Lowest first cost. Lowest installed cost.

Lowest maintenance cost.

Unique Simplicity — exclusive design permits fixed, optimum proportioning and reset values for liquid flows. Adjustable reset optional for gas or steam flow.

THE FOXBORO COMPANY, 9611 NEPONSET AVENUE, FOXBORO, MASS., U.S.A.

FOXBORO
REG. U. S. PAT. OFF.

FLUID FLOW CONTROLLERS

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

STUDENT MEMBERS

OF THE ASME

you can get—

A LITTLE CASH!

A LITTLE FUN!

A LITTLE FAME!

HERE'S your opportunity to get that for which you have lacked the wherewithal. There's just one catch—you will have to work for it! If you quit easily—don't read any further. Perhaps a little extra work on your thesis will do the trick.

An engraved certificate signed by the President and Secretary of the Society will accompany each award.

A trip to the Annual Meeting as a guest of the "Old Guard" will be awarded.

Students should consult the Honorary Chairman regarding the rules for these awards. Only papers by single authors will be considered.

Each student must submit his paper to the Vice President of the Region in which his Student Branch is located not later than ***May 15, 1955.***

$150.00

For the best paper by an undergraduate on the subject "The Atom and the Mechanical Engineer." This is the Charles T. Main Award.

An undergraduate must submit his paper for the Charles T. Main Award or Undergraduate Student Award before thirty days after the completion of his undergraduate work.

$25.00

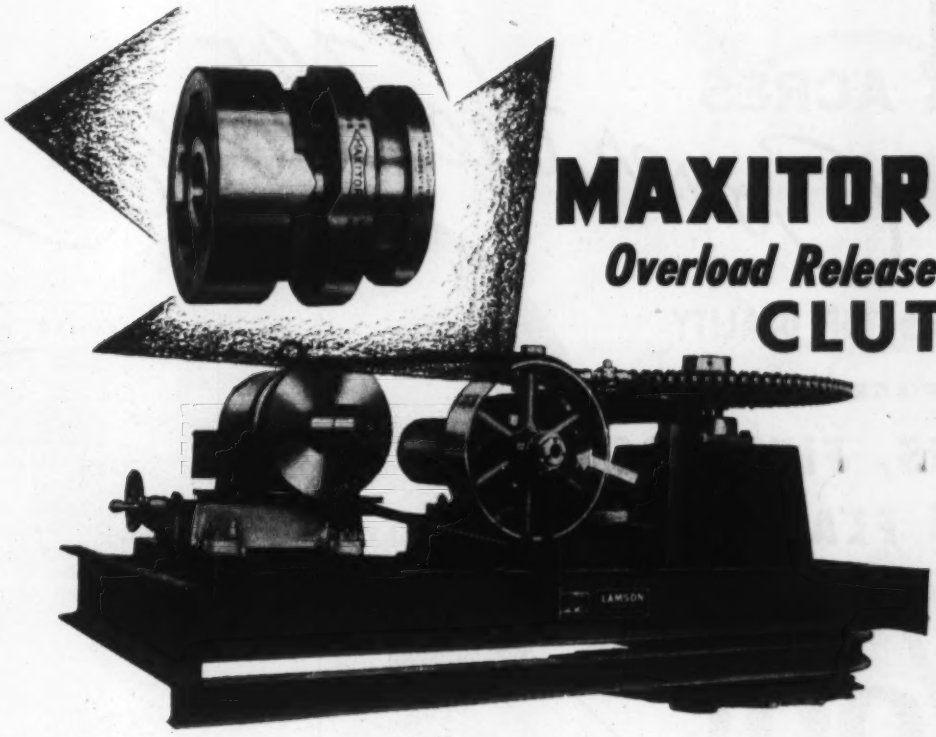
For the best paper on an engineering subject by an undergraduate. This is the Undergraduate Student Award.

$25.00

For the best paper on an engineering subject by a graduate student. This is the Postgraduate Student Award.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th St., New York 18, N. Y.



MAXITORQ
Overload Release
CLUTCH

protects against conveyor overload

FOR THE LAMSON CORPORATION

This prominent Syracuse, N. Y., manufacturer of materials handling equipment has selected the Maxitorq Overload Release Clutch for power transmission on its drive unit for the Lamson overhead conveyor. On installations which handle heavy loads the cam design feature automatically causes instant disengagement of the clutch when the overload is substantially greater than the normal driving load . . . thus preventing damage to product and machine.

The Overload Release Clutch has all of the highly favored features of the standard Maxitorq floating disc clutch . . . Separator springs that keep discs "floating" in neutral . . . no drag, no abrasion and, consequently, no heating in neutral. Assembly, adjustment and take-apart are made without use of tools. Engagement is easily controlled, with light pressure. Disengagement is instant and complete.

There are six capacities, ¼ to 5 h.p. at 100 r.p.m. Maximum working torque from 13 to 263 ft. lbs. There are so many varied applications of this Overload Release Clutch that we suggest submitting your clutch problems to our engineering department for practical recommendations. In other words, "let's talk Maxitorq."

4 CJ 54

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THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

24 ACRES *Cover the World*

. . . with TOP QUALITY

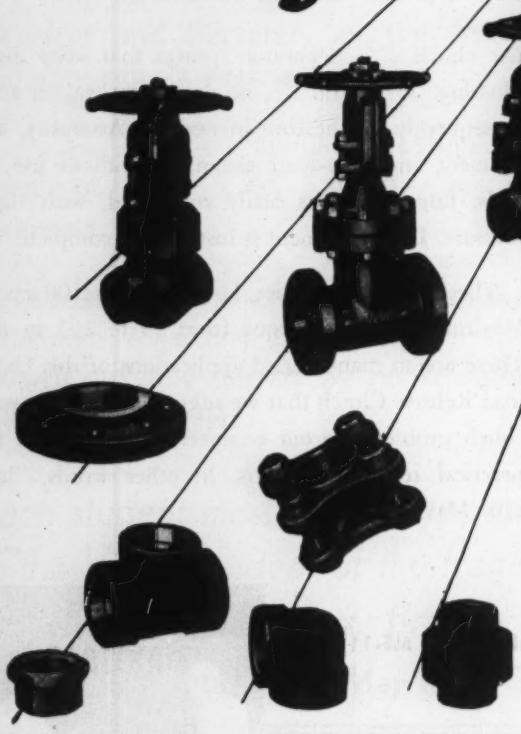
DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt

Air View of
Henry Vogt Machine Co.



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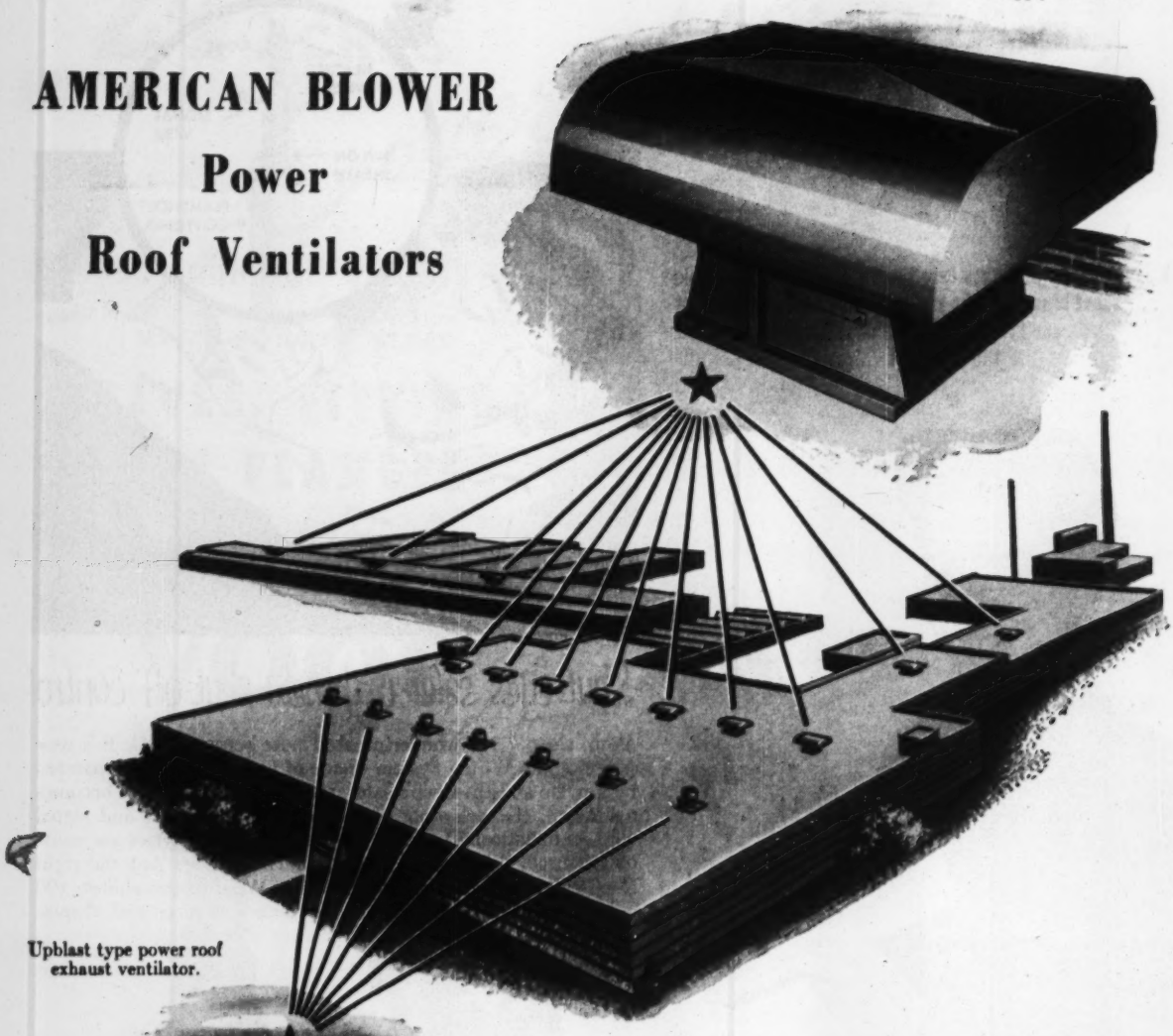
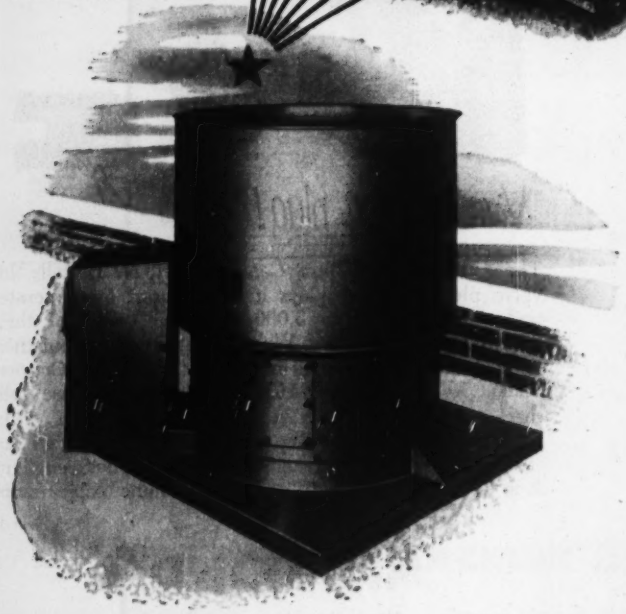


Upblast type power roof exhaust ventilator.



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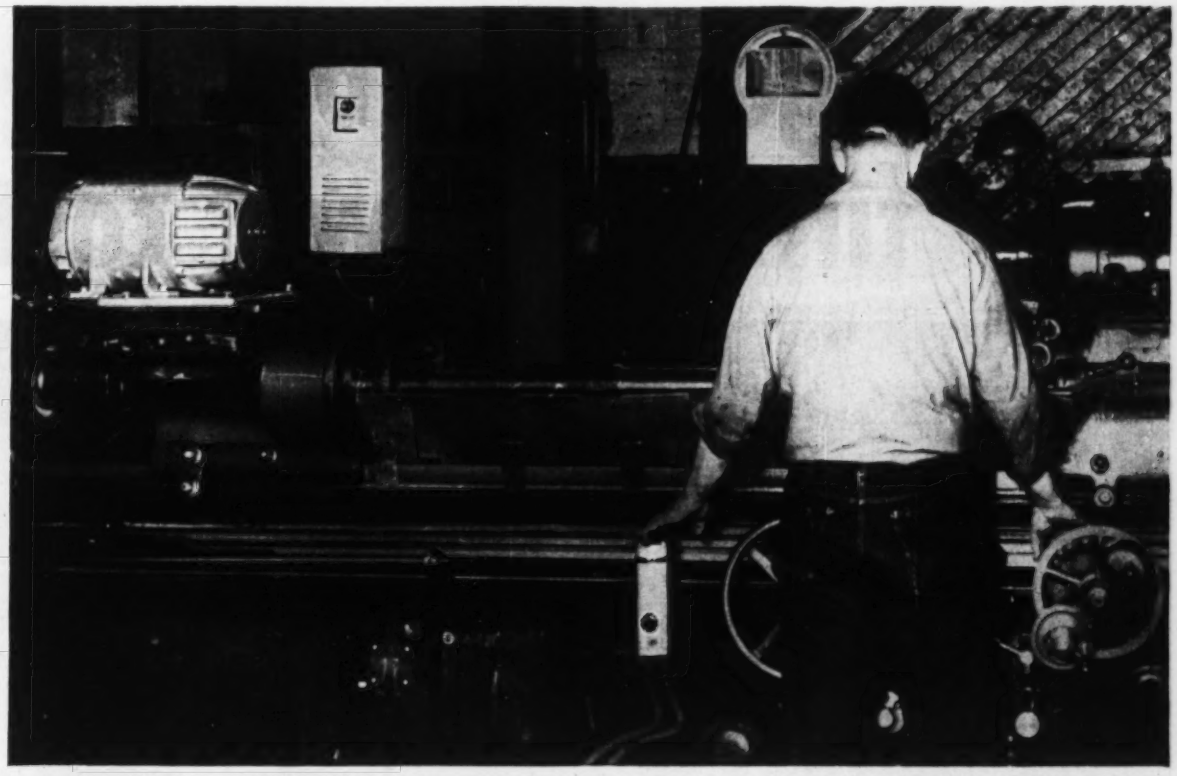

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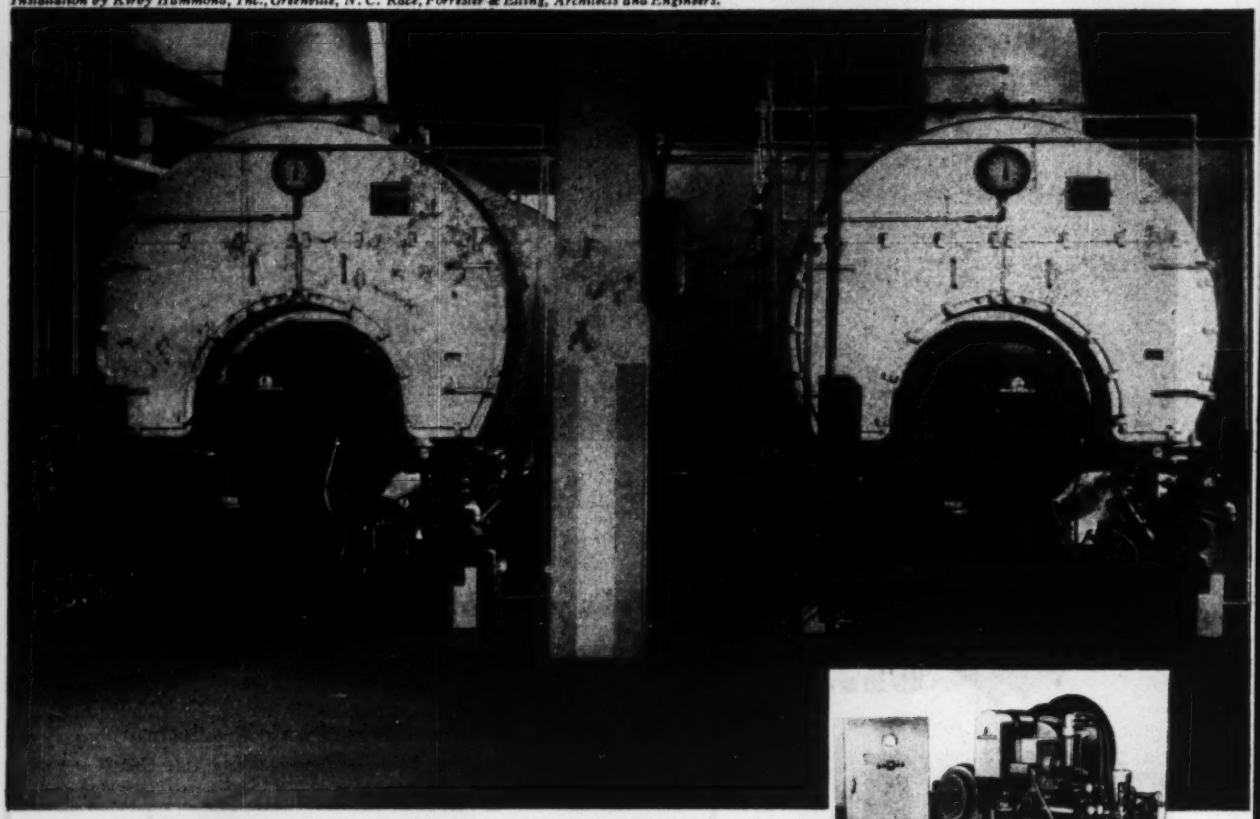

Iron Fireman packaged industrial oil burners integrated with Scotch marine type boilers in the plant of Belrug Mills, Inc., Greenville, South Carolina. At right, Iron Fireman oil-gas packaged unit. With this unit it is possible to switch fuels at any time, at a moment's notice.

Engineered as a single complete unit

This Iron Fireman package unit is much more than a conversion burner. It's a complete combustion system in which all elements are correctly balanced and integrated—a thoroughly engineered firing plant. It includes burner (for oil or gas or both), fuel system, forced draft air supply, control panel, and pre-formed refractory combustion throat. Installation requires little more than bolting the entire unit to the boiler front and making service connections for power and fuel.

To the user this means an attractive saving in installation time and cost. But even more important, it means a factory assembled and tested unit instead of a locally assembled job. It means dependable performance and high operating efficiency, with substantial fuel savings. It's the *smart* way to modernize your boiler room.

Get in touch with your Iron Fireman dealer, or mail the coupon on the opposite page for complete information.

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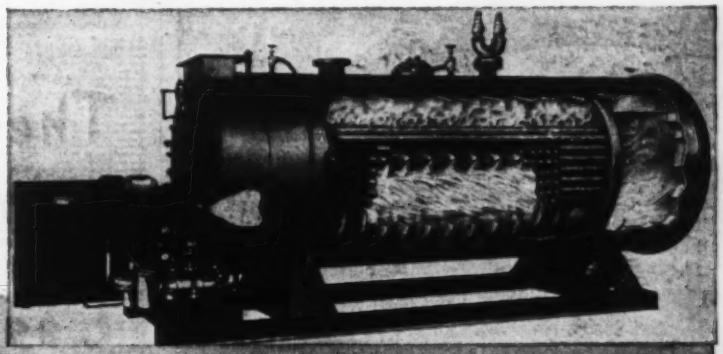
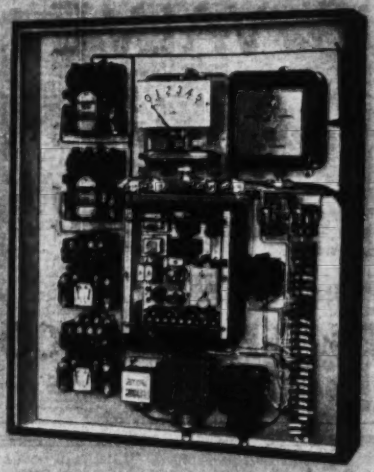
OIL, GAS or OIL-GAS COMBINATION BURNER UNIT BY IRON FIREMAN



Cutaway view of packaged boiler-burner unit consisting of Scotch marine boiler with Iron Fireman combination Gas-Oil forced draft burner. The shift from one fuel to another is accomplished quickly, with no sacrifice in firing efficiency.



WIRED, TESTED CONTROL PANEL

Control panel is totally enclosed, with all instruments wired and tested at the factory. Entire wiring system is coded, with varicolored wires and numbered terminal strip inside panel. An indicating meter on the panel door shows the condition of the control system at all times. Indicating lights on panel front show operating status of unit at a glance. Green lights show motors in service; red indicates safety lockout.

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First, decide what fuel or fuels you want to use (oil, gas or oil-gas combination). Second, determine the load. Third, refer to table in Iron Fireman catalog or specifications for the correct size of burner and boiler for your job.

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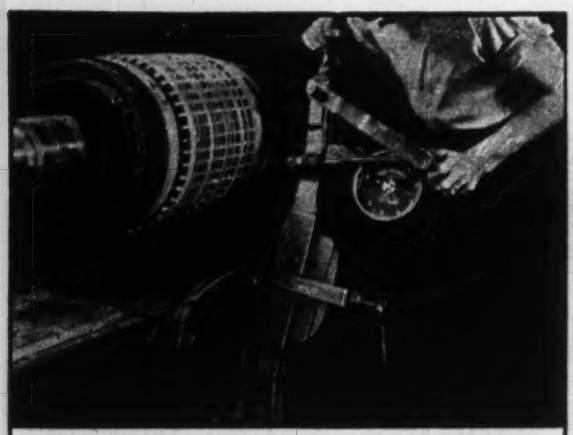

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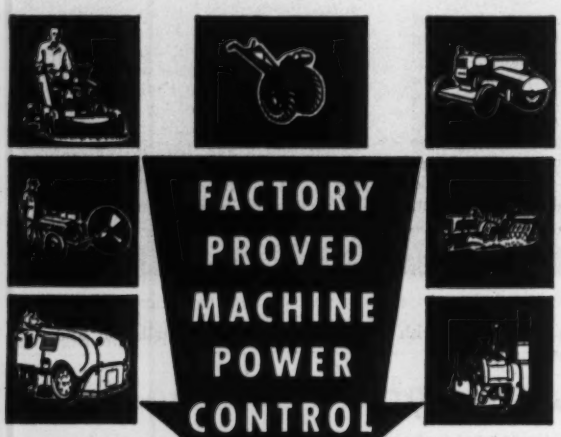

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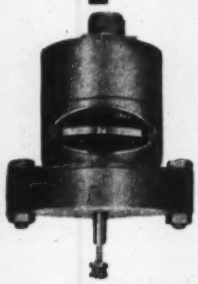

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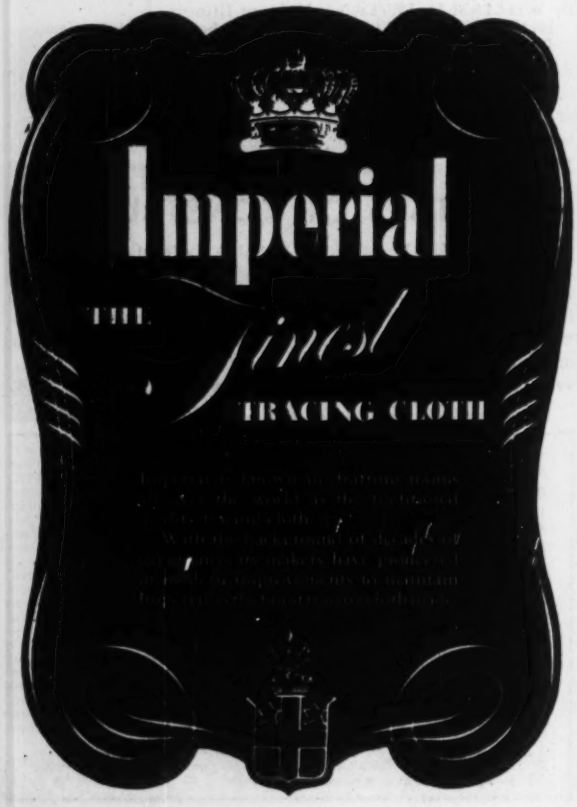

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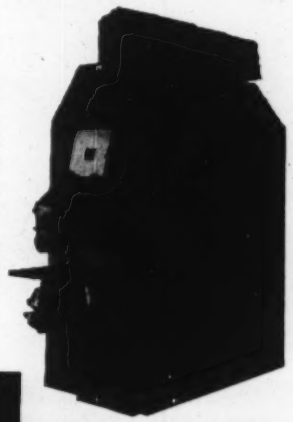

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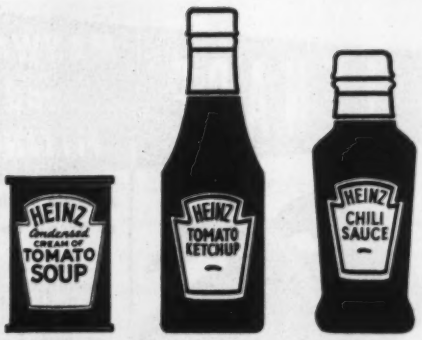

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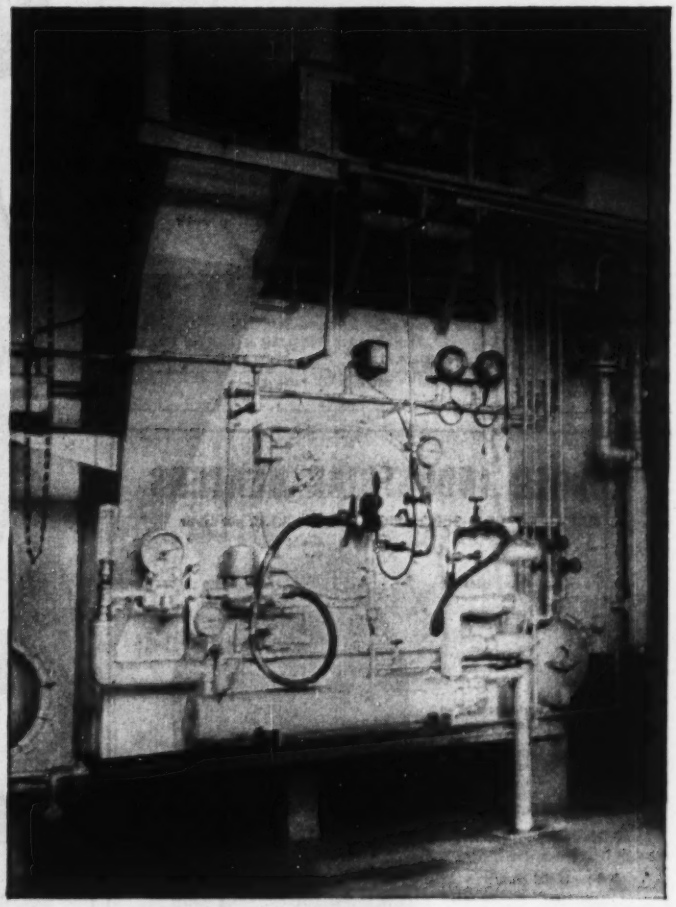

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Graduate Mechanical Engineer, 35 or under, minimum experience four years, to serve as Assistant Project Engineer, or as Project Engineer in Research and Development of unique Ordnance materials and equipment. Positions are open for qualified engineers interested in High Speed Photography, Analysis of High Speed Film, Electronics, Instrumentation for New and Untried Applications, Ordnance Ammunition and Weapons, and Parachute Design. Engineers must have the initiative and ability to supervise all designing, developing, testing and instrumentation associated with the project. Excellent opportunities for advancement to Chief Project Engineer or Assistant to the Director for an individual who applies himself. Our Research Division is young and progressive, with long range plans for immediate expansion into many fields of research. Please send complete resume.

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These positions require men with a degree in either mechanical, metallurgical, aeronautical or electrical engineering, theoretical and applied mechanics, or physics. In addition—

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A man with formal education in vibration analysis with emphasis on theoretical approach.

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Some knowledge of the study of fatigue of metals and fatigue testing techniques. Also familiarity with methods of experimental stress analysis.

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Division of
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Large successful manufacturer of heavy home appliances, seeks product engineer.

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Successful and rapidly expanding company, leader in its field, seeks assistant project engineer with electronics experience, preferably in automotive or heavy home appliance field.

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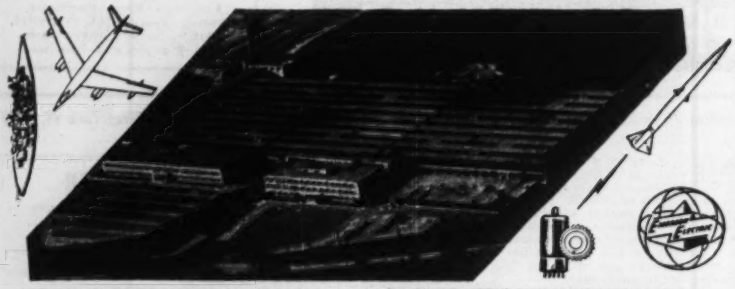

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Positions open include:

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Graduate ME, to study and solve problems in design of jet engine controls for fuel system cooling, methods of augmentation modulation, rigging methods, etc.

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Recruiting & Placement
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DESIGN ENGINEER—Experience on elevated tanks and towers of modern design. Unusual opportunity with progressive eastern corporation for man with ability to assume complete charge of design, manufacture, and direct erection. Address CA-4839, care of "Mechanical Engineering."

PROJECT ENGINEER—for the development of air conditioning equipment. Must be a graduate engineer, experienced in the design and development of hermetically sealed refrigerating circuits and heat transfer surfaces. Excellent position with well known manufacturer. Location Mid-West. Send complete resume of education, experience and salary requirements. Address CA-4853, care of "Mechanical Engineering."

TRANSLATORS & EDITORS—European and Asiatic languages in all branches of engineering and physics. Fluency in English required. Full time, part time, or free-lance. Replies held confidential. Submit resume to: ATS, P.O. Box 271, East Orange, N.J.

ASSISTANT CHIEF ENGINEER—for graduate mechanical engineer, under 50 years of age, having minimum of 15 years' good industrial plant experience. Position entails wide range of engineering work including operation and maintenance of boilers, milling plant, sugar processing equipment and corollary facilities. Large American-owned sugar company operating in Cuba. Good quarters furnished by Company. Salary not subject to U.S. income taxes under present laws. Reply giving complete details, stating age, marital and military status, experience, technical training and salary requirements. Reply will be held confidential. Address CA-4863, care of "Mechanical Engineering."

PROJECT ENGINEER—with creative aptitudes for paper machinery development—New England area. Applicant must be somewhat of a physicist who can readily apply fundamental laws of thermo-dynamics, heat transfer, fluid dynamics and applied mechanics to creative work. He must be able to think in terms of and perform simple experiments for verifying ideas. He will be expected to make design layouts and specifications for subsequent entailing and manufacture. High speed paper machine design or operating experience is desired but not essential. This is real opportunity for the young engineer who wants to play an important part in a fast growing industry. Salary will be commensurate with experience. Applicants to enclose photograph with complete resume of educational and industrial backgrounds including present salary and salary expected. All applications will be acknowledged, and will be held in strict confidence. Address CA-4809, care of "Mechanical Engineering."

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Additional Opportunities are offered in the display advertisements— on pages 56, 66, 72, 74, 76, 78, 80, 83, 87, 139

POSITIONS WANTED

MECHANICAL ENGINEER—28, BSEE, BSBA, licensed in N. Y. & Conn. 3 yr. as a mfg. trainee and industrial engineer. 3 yr. as a tool and process engineer. Desires position with challenging and varied problems. Address D. W. Kornreich, 3004 Woodbury Rd., Shaker Hts., Ohio.

SALES ENGINEER, BE, MS, Age 30, 7 years industrial experience including 3 years in sales of heavy equipment at executive level. Address CA-4843, care of "Mechanical Engineering."

MANAGEMENT ENGINEER & BUSINESS ANALYST—BSME—Member ASME—20 years' diversified experience in industry and government both USA and overseas. Desires work, procedure and cost reduction studies, cost and flexible budget control, profit planning, work simplification, systems and methods, production control and planning, manufacturing analysis, preventative maintenance, supervisory training and safety programs. Address CA-4845, care of "Mechanical Engineering."

EXECUTIVE ENGINEER—41—BSME—registered P.E., inventive, energetic, experienced organizer. Can get sustained top results in design, development and testing of complex mechanical and electro-mechanical systems and structure. 20 years' experience including 4 diversified, 12 in aircraft and 4 in missile development. Will consider new fields. Present salary $12,000. Address CA-4856, care of "Mechanical Engineering."

MECHANICAL ENGINEER—desires part time employment with Architect and Engineers firm or Constructors. Six years' diversified supervisory experience in manufacturing and machinery installation and piping installations. Experienced in specification and report writing and follow up of contractual obligations. Age 28. BSME. Address CA-4858, care of "Mechanical Engineering."

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SALES ENGINEER—BME, ASME. At 32 I want to start a career in SALES. 8 years' broad production and mechanical engineering experience in the metal working and electronic fields plus the intense desire (with established aptitudes) to enter technical selling may be a valuable asset to your organization. New York area preferred. To learn how I could be of value—address CA-4865, care of "Mechanical Engineering."

MS in ME, M.I.T.—PE, reg N. Y., TBP, PTS, 30, married, Korea vet. Varied experience, mainly heating, oil burner development, business admin. Desire responsible position with opportunity advance management. Address CA-4866, care of "Mechanical Engineering."

MECHANICAL ENGINEER—BSME, age 30, married, 5 years' experience design installation and service of equipment in automobile plants. Desires position of Sales Engineer in Detroit area. Address CA-4868, care of "Mechanical Engineering."

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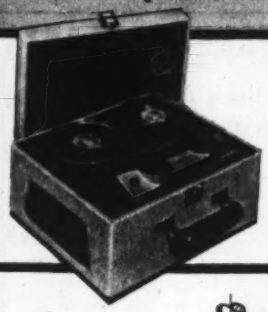

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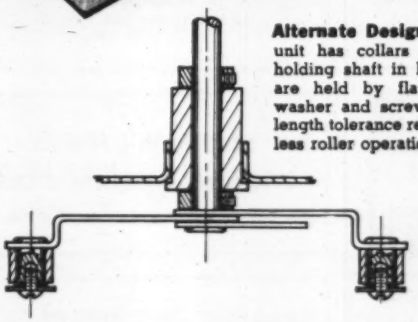
Made lighter, more compact and efficient, and produced at lower cost when Waldes Truarc Rings replace bulkier, more expensive fasteners.

Alternate Design: Pressure Pad Assembly. Collar and set screw secure pressure bar and spring.

Truarc Design: Truarc Grip Ring replaces collar, reduces size of assembly, saves $.02/unit.

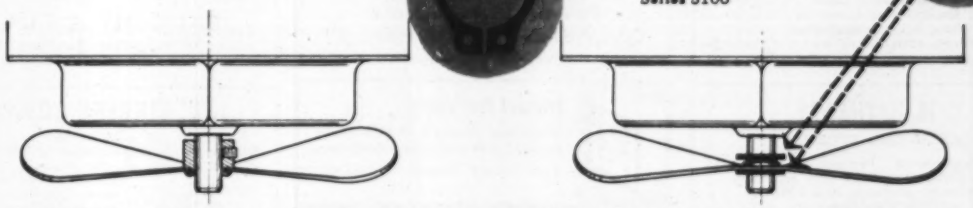


Alternate Design: Wind-rewind unit has collars and set-screws holding shaft in bearing. Rollers are held by flat washer, lock washer and screw. Critical shaft length tolerance required for faultless roller operation.

Truarc Design: Two Truarc Rings (series 5100) replace collars and screws, save $.04 per unit. Rollers are held by two Truarc Grip Rings. Eliminates tapping and close tolerances, saves another $.04!

Waldes Truarc Grip Ring Series 5555

Waldes Truarc Retaining Ring Series 5100



Alternate Design: In motor-fan assembly, hub is secured rigidly to fan blades by staking. Fan assembly is secured to shaft with set screw.

Truarc Design: Two Truarc Grip Rings (series 5555) plus spring-type bowed washer save $.07 per unit...allow fan to slip if obstructed.

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MECHANICAL ENGINEERING, 29 W. 39th St., New York 18, N. Y.

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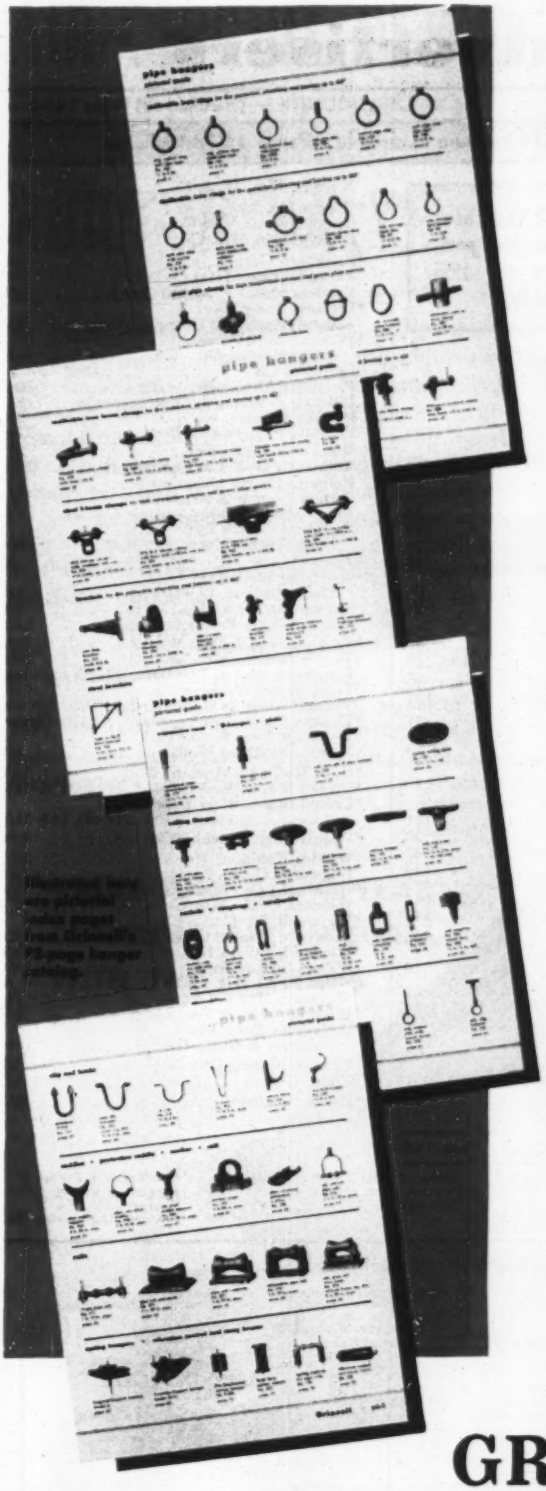

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If some detail of piping arrangement should make it necessary to deviate from hangers of standard design, it is important to remember that Grinnell will design and manufacture hangers to meet your special requirements. This is a service Grinnell freely offers.

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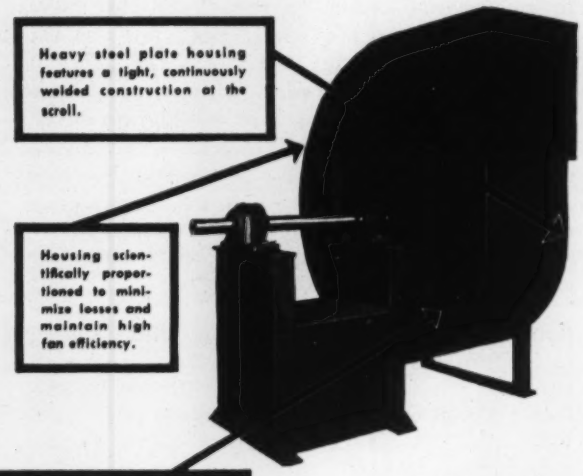
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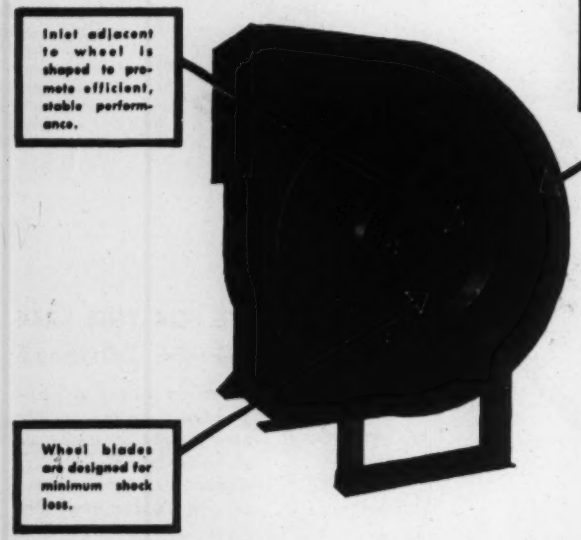
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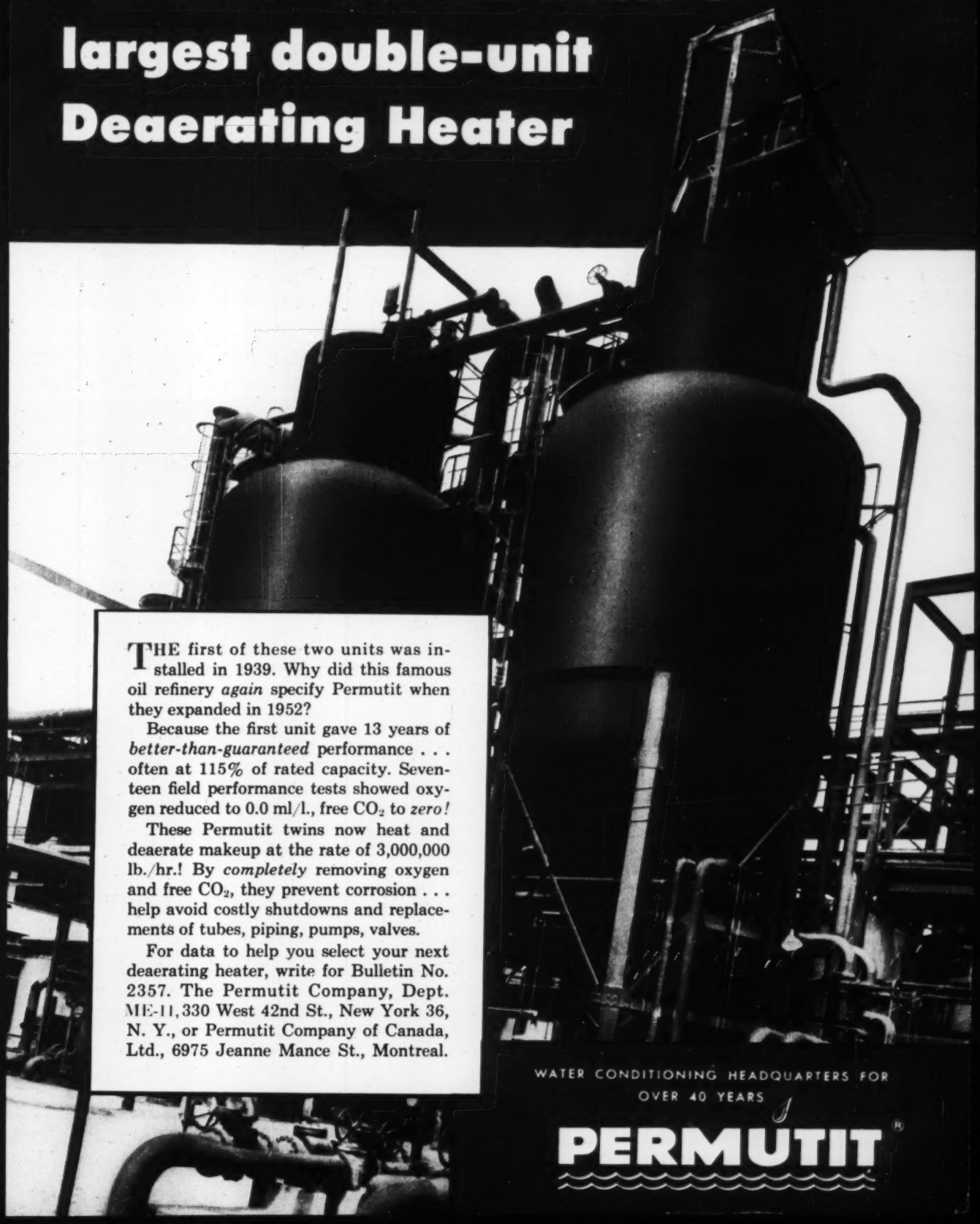

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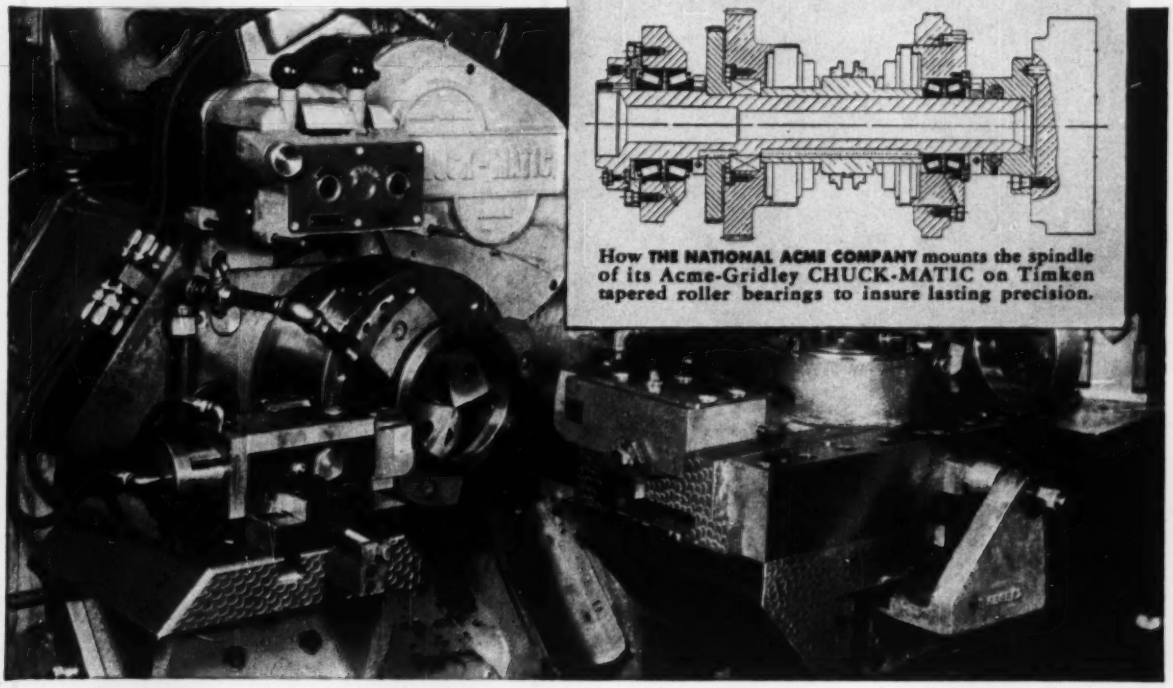

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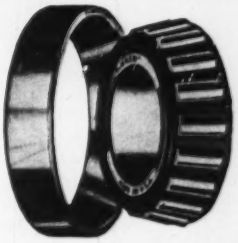

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